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GEOLOGY AND PALÆONTOLOGY.

BOTANY AND EVOLUTION.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

I. PLANTS—FOSSIL VEGETATION.

A great American botanist has stated that evolution is a problem the solution of which is reserved to vegetable palæontology. Let us, then, see what light can be thrown on this great question by a study of fossil plants.

The botanist, looking at the changes of plants living under his observation, can be excused in concluding that one form has been derived from another. He finds a marked variation in a single generation, and he hastily concludes that a hundred generations will give a hundred times as much variance. But a more careful observation will teach him that the divergence from a normal standard is confined within a limited and fixed circle. Beyond that circle, a hundred generations will not change it.

It is true that our first and oldest type of vegetation in the oldest strata of the Silurian Age, is of a low order. It is represented by marine families (Thallogens), which to-day, all over the ocean, are of simple organization. The close resemblance between the earliest forms and those now found in the ocean is very apparent. Thus the genus *Chondrus crispus*, or Irish moss, is represented in the lowest Silurian by three species. *Palæchorda*, or Dead-man's-rope, now living, is also found in the same beds with nearly generic structure. In short, the whole aspect of the Thallogens of the oldest fossiliferous rocks is so like the present that if we

accept the one as the lineal descendant of the other, we should have no change of type, no new organs, nor, in fact, any development of a single new trait in these low plants in fifty millions of years.*

As in the Lower Silurian Age there was little, if any, dry land, we could not expect other forms. Scarcely any dry land existed till the Devonian Age, and then only in a limited extent. Even in that era we have few land plants.

At the close of the Upper Silurian we find the first land plants—Lycopodons, or Ground-pines. If not generically the same as those now living, they are very closely allied. These are not the lowest land vegetation, but are Acrogens, the highest of the flowerless plants. Mosses, lichens, and other lower orders, had not yet appeared, and are not known till near the close of all geological history.

But what is more striking in illustrating the progression of vegetation, is the appearance, about the same time, of one of the most common families of our present forest—viz., the Conifers, or Pines. Nor is there the slightest evidence that these Pines had any connection with, or derivation from, any lower type. Both Lycopodons and Conifers have also retained their distinctive characteristics from that time to the present without changing to any higher order, or merging into any advanced vegetation. The *Araucaria*, now living, is recognized by all botanists to be of the same genus with the pines of the earliest Devonian. In plant rank it stands as high as the Norfolk Island Pine or the Cedar of Lebanon.

The Pines, it must be recollected, were the first *trees*, and, though it is sometimes difficult to say that one order is higher than another in organization, yet no botanist will assert that the Pines are low. While our shade and fruit trees (Oaks, Apple, etc.), are placed higher, the Cycads and Palms are, without question, much lower than Conifers. Yet the Cycads first appeared in the Carboniferous Age, and the Palms in the Cretaceous. If vegetation developed from a lower to a higher type, the Palms should have existed long before the Cycads, and both far in advance of the Pines. The latter, instead of being in the Devonian, should have lived after a later interval than the former; or, rather, one should have been seen to merge into a higher type and disappear in it, ceasing to be found in its first form, and only represented by a more noble organization. The Palm should have ceased in the Cycad, and the latter in the Pine, dropping all old forms and habits, just as the offspring throws off the embryonic and assumes the features of maturity.

Is it not antagonistic to the doctrine of evolution, that we have Lycopodons, Cycads and Palms, to say nothing of more simple forms, living side by side with our more complex and highly organized vegetation? This anomaly exists in almost all divisions of natural history. No family is now without its low organisms living with the higher; and very frequently the lowest of the present are far inferior to any of their classes found fossilized. If evolution requires for a beginning only low families, genera and species, the latest and most recent periods should possess only the highest.

* Prof. J. D. Dana says the oldest fossils of the Silurian are not less than fifty millions of years old. I shall use these data in the relative ages of plants in different deposits, in this article.

The geological history of the Pine is very instructive in the study of evolution. From its first appearance, in the fossil state, to the Age of Man, it has retained all its characteristic features without any material variation or advancement, for it is difficult to see how much, if any, superiority exists in the more common Pines over the *Araucaria*, or type of the Devonian and Carboniferous ages. The forms of the fruit (cones) and leaves have not made any important changes during half the period of the earth's geological history. From the Upper Silurian to the present era, a period of not less than twenty-five millions of years, the normal style of trunk, with its annual rings, leaves and cones, has remained the same. Not only this, but even the microscopic structure of the wood has remained persistent. It has not, and never had, the ducts common to the Dicotyledonous trees, now represented by all other forest trees of the temperate zones. Even the form of the cell, with its minute makings, so small that a high magnifier is required to see them, has remained the same. The elongated form of the cell, with its dots, or thin spots in the walls, is still preserved during these long geological periods. When we consider that the cell is only one three-hundredth of an inch in diameter, and the wall is only a fraction of this diameter, and the thin spot is only half the thickness of the wall, is it not most remarkable that this most minute structure should always have remained?

We give figure 9, showing a portion of a cell of *Pinus strobus*, or common white pine, with dots, magnified three hundred times. Figure 10 shows portions of four cells, on the same scale, of Australian Pine, *Araucaria Cunninghami*. The latter agrees with the old Devonian fossils. The diagrams show that the only difference in these extreme genera is that the dots in one are placed opposite each other, while in the other they are alternate. It will thus be seen that there is little, if any, variation, even in the most minute portions of the tree. If that portion of the cell, not more than one ten-thousandth of an inch in thickness, has not changed its structure in one-half of the earth's geological history, does it not show that the ruling law in the vegetable world is persistence, and not change—a fixed normal standard, and not a progressive, changeable element?

During all the existence of the Pines, since the Silurian, in every later geological formation, and in almost every portion of the globe, under all the varying conditions of our planet through these twenty-five millions of years, we discover no divergence of the characteristic form of the tree, or its products, toward any other family of plant life. We find none running to it and none diverging from it. Many other lower forms have succeeded, instead of preceding it.

Fig. 9.

Fig. 10.

The *Araucaria* of Australia and Patagonia, though called in the books by different specific names, may be the lineal descendants of the oldest Silurian. Were it not the habit of

Fig. 9, fibres of ordinary coniferous wood (Pinus Strobus), longitudinal section, showing dots, magnified 300 times; fig. 10, same of the Australian Conifer, Araucaria Cunninghami. After Dana. Manual p. 134.

palæontologists to give a new name to a familiar fossil when found unexpectedly in another geological formation, they would probably have been recognized as the same species.

All our distinguished fossil botanists have recognized the persistent characters of the Conifers. Frequently they express this opinion pointedly in reference to particular species. Saporta and Marion, in their "Flora of Gelinden," speaking of *Pinus Quenstedti*, which is found in Kansas in the lowest Cretaceous, and in Greenland in the highest, say: "This species does not differ in character from the living Mexican species with quinate leaves." So *Sequoia fastigiata*, in the deposits of Kansas, Moletin and Greenland, is considered by Lesquereux very nearly the same as the living *S. gigantea*, or the "Big Trees," of California. Prof. Gray expresses his idea of the close resemblance in the following terms: The twigs of the *Sequoia* in the Eocene are "so very like *S. gigantea* of the Sierra Nevada that, if such fossil twigs, with leaves and cones, had been dug up in California, instead of Europe, it would confidently be affirmed that we had resurrected the veritable ancestors of our giant trees." Thus closely do the fossil *Sequoia* of the Cretaceous and Tertiary deposits of Kansas, Greenland and Europe agree with the living trees of California. The Bald Cypress, now our only living species, has a close ally in the Cretaceous *Glyptrostrobus*, "a sort of modified *Taxodium*, about as much alike as one species of Redwood is to another."

It must not be forgotten that the Pine grows in most varied climates, and in most diverse positions. It is found near the snow-line in Colorado, 11,000 above the sea, and on the level of the ocean in the same latitude; on the damp shores of Maine and the dry plains of the West; on stony hills and in fertile valleys. Note the great change of circumstances under which the Auraucarian Pine has existed without varying from its original structure. Since its birth on the small and scattered islands of the old Silurian ocean, every foot of land has been repeatedly submerged. The Pine has been obliged to migrate from place to place to retain a footing above the sea. All our continents have been formed and reformed. Our mountain ranges, in every quarter of the globe, are young compared with this genus of trees. The wet, tepid climate of the Carboniferous, and the semi-tropical of the Mesozoic ages, were succeeded by the Glacial Period, which covered half of the Temperate Zone with a sheet of ice a mile thick, and yet, amid all these vast mutations, the *Araucaria* has remained unchanged. Could any more diversified circumstances be imagined to affect the growth of a plant? Can any more definite evidence be given that changing circumstances cannot carry organic life beyond its narrow circle of vitality? Surely, if physical variation of the earth's surface, and vacillation of climate, could change a plant, the Pine might, during so many millions of years, have shown almost any change.

After the introduction of the Pine, the next important grade of plant life is represented by the Cycads. They are a comprehensive type, combining some characteristics of Ferns, Palm and Pines. They approach the last more nearly than either of the others, particularly in flowers and fruit. They differ from the

Pine in several respects, but mainly in secreting starch in a large pith, instead of rosin in the outer or sap layers, and in having ring layers which are not of annual growth. They grow only in the Tropics, while the Pines extend to Temperate and sub-Arctic regions. All these peculiarities the Cycads retain from their first appearance to the present time. The comprehensive, or "prophetic," features, therefore, fail of any result. They are still seen in the living Cycads. There is no preceding form from which they were derived, and, while they held their permanent form, they had no collateral branch connecting them with the Pines or any other allied type.

As a comprehensive type, the Cycads appear in the wrong relative position. If they were "prophetic," they should have preceded the Ferns, Palms and Pines, whose features they embrace. These comprehensive forms have accompanied other families, both in the animal and vegetable kingdoms, and have either succeeded or run parallel with the more specialized forms, into which they are said to have been developed. All the more important comprehensive orders are living at the present age, when they should have long ago disappeared in the higher structures which they foreshadowed. If they were the ancestry of those having more special forms, they should have appeared first, and, becoming merged in the more perfect types, should have disappeared in the metamorphosed structure.

The extremes of the earth's physical features attending the existence of the Cycads, have been nearly as great as we have noted in relation to the Pines; yet all these vicissitudes of circumstances have not changed their generic traits.

Although the Palms are far inferior in structure to the Cycads, they did not appear till long afterward, viz.: at opening of the Cretaceous Age. So that, instead of appearing earlier than the Cycads, as they should to be in harmony with the theory of development, they are less than half as old. It is also singular that the Palms should have first been found with the first of the far higher grade of Dicotyledons, the two extremes of trees thus appearing simultaneously. Can this incongruity be explained by any principle of evolution?

The persistent characteristics which we have noticed as pertaining to the Pines and Cycads, are true of the Palms. When they first came into existence they had all the marked features of structure which they retain to-day. No derivation from or divergence into any other type has been discovered, though carefully sought. The genus Sabal is the earliest known, and yet it now lives in the Tropics, no more perfect and no less perfect than in the early Cretaceous Age. It always comes from the ground with one cotyledon, and never had the power to add another. Its tuft of parallel veined leaves has never shown any ability to reticulate. Its internal fibrous texture has never become consolidated into annual layers. In short, it is still not only a Palm, but a Sabal.

When the Palm first appeared it had a wide geographical range. Its remains are found on both continents, and it always entered on the stage of plant life with the higher Dicotyledons. It grew in Europe when that grand

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division of the globe was represented by a few islands. It flourished on an archipelago where now is the center of North America, before the Rocky Mountains had begun to rise out of the ocean. Here have been changes sufficient to have modified the tree had it been susceptible of evolution, and to have developed it into a different plant life. But when conditions were opposed to Palm life, it did not change, but migrated (by floating seeds), or became locally extinct. Like all other vegetation, as geology reveals it, the Palm shows a strong stability in maintaining its normal form. No fossil exists from which it was derived, and, in its long history, extending through one-eighth of the earth's organic period, it has left no traces of divergence to a higher plant life.

Figure 11.

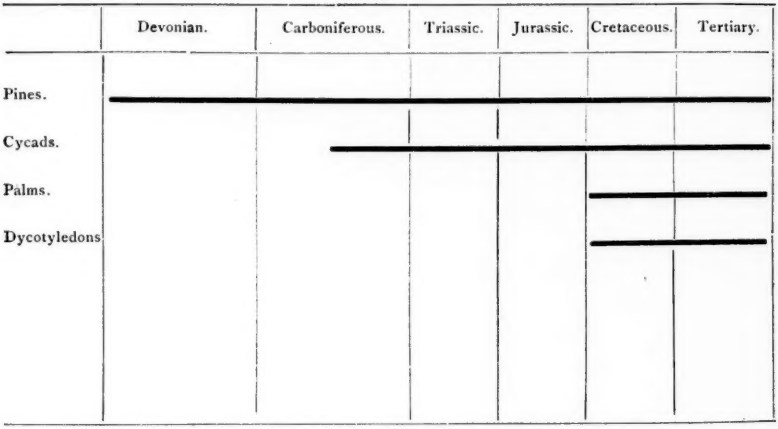
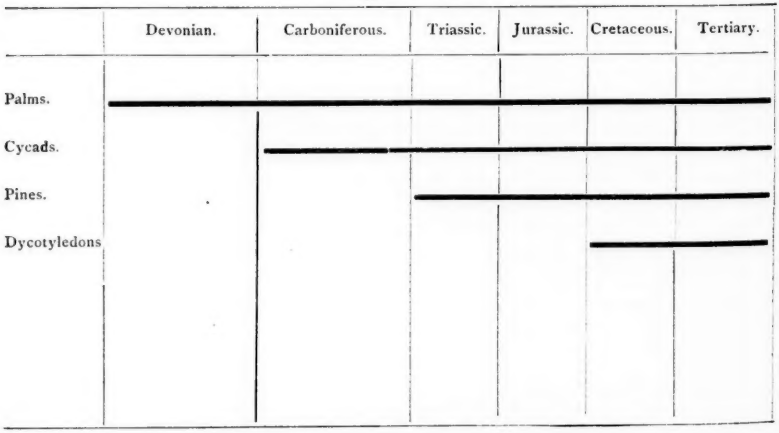


Figure 12.



To show more clearly the contrast between the actual times of the appearing of the trees of different families, and the theoretic times in which they should have appeared, we give two diagrams, or figures. Figure 11 presents the true history according to the evidence of fossils, and figure 12 gives their relative order of birth according to the theory of evolution. The facts and theory, it will be clearly seen, are in strong contrast.

These figures begin with the Devonian Age, or the latter half of the earth's history. We omit the Silurian, as the ocean then covered so much of the surface of the globe that none but marine plants had opportunity to grow. It will be seen that the Palms and Dicotyledons came in together, when by their rank they should have been at the extremes. The Pine is about four times as old as the Palm, when it should be less than half as old. Or, if we compute by years, the Pine has existed for not less than twenty-four millions of years, and the Palm six millions of years. In figure 12 we do not pretend to give an accurate rank of the trees, as no standard can tell us how much the Oak outranks the Pine, or how much below the Pine we must place the Palm. But it may be considered a fair approximation.

We do not forget that we shall be reminded of "the great imperfection of the geological record," and that we have not yet discovered all the fossils of the old Flora. But the number of species of fossil plants now known and described is over 7,000, of nearly 900 genera. There is now no more proof that these chasms which connect the extreme forms will be bridged over, than when one-seventh of that number was known. There are no more species, showing a development from a low to a higher type, than when Professor Darwin first began his labors. On the other hand, all the recent discoveries have settled the question most clearly, that in plant life there are no forms which have been derived from a lower, or developed into a higher, organized plant.

(*To be continued.*)

THE HOME OF THE MASTODON.

New York has always been historic ground for the mastodon. The earliest account which we have of the remains of this animal is found in the "Transactions of the Royal Society of London for 1714," where it is stated that two large teeth and a femur were found at Claverack, N. Y., in 1705. From that time until the present day, skeletons or parts of skeletons have frequently been unearthed in that portion of the State lying west of the Hudson. The finest specimens in the museums of this country have been found in New York, and two of them, at least, in the immediate vicinity of the Hudson. The very perfect skeleton found near Newburg in 1845, on the farm of Mr. Brewster, and now generally spoken of as the Warren mastodon, is at present in the Boston Museum. The Cohoes mastodon, which was brought to light in September,

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1866, on the grounds of the Harmony Mills Company, is also quite perfect, but was not found in the place in which the animal died. The bones were taken from a large pit in the rock, evidently formed by the wearing into each other of a number of pot-holes, forty feet in width and of about the same depth. They were imbedded in turf or peat, which contain many fragments of wood, some of which were so well preserved that they were identified as white pine, hemlock, black spruce, larch, swamp maple and white birch. It was conjectured that during a freshet some large beaver dam had been swept away, and the rush of water had carried along the loose bones which, falling into the cavities in the rock, were there preserved for ages, to be finally unearthed and placed in the State Museum at Albany. The last important skeleton came from Otisville, in Orange county, where it was discovered in 1876. It is now in the Peabody Museum of Yale College, and is very nearly complete, only the tusks, hind legs and tail being wanting. The tusks will probably never be recovered, as the chances are that they have rotted, and, if found at all, will be in a fragmentary condition. The legs and tail, however, will no doubt come to light when further excavations in the swamp shall have been made. The bones of this skeleton are not at all changed; that is, they are still bone, although they have lost some portion of their animal matter. Indeed, mastodon bones in this country are not usually petrified, for the mastodon was, geologically considered quite recent. Preglacial he was, of course, for specimens from the Big Bone Lick in Kentucky, consisting of bones, tusks and molars, show marks of the journey in the ice, being much scratched and worn.

But in this country the true proboscideans seem to have made their appearance in the later tertiary, and to have become extinct before the historic period. This is, of course, only another way of saying that we know nothing about when they did disappear from the land. The history of America begins substantially with its discovery by the whites, so that we have as yet no certain means of knowing whether the primitive man of America once hunted the elephant and mastodon or not. It is hardly doubtful, however, that man and the proboscideans were co-temporaneous on this continent. It is true that the evidence by which Dr. Koch claimed to have proved this fact beyond a doubt has been shown by Prof. Dana to be at best very untrustworthy. Koch claimed to have found bones calcined by fire as well as to have discovered flint weapons mingled with portions of a skeleton in a swamp. The fact, however, that one or two specimens of antique aboriginal pottery have been found ornamented with unmistakable figures of an elephant's head is very important, and unless it could be explained away by showing that the pieces supposed to be ancient were really modern, would have great weight. The evidence adduced by Professor J. B. Whitney, in his very important work on the "Auriferous Gravels of the Sierra Nevadas," appears to establish pretty satisfactorily the contemporaneity of the two species. If this evidence can stand the criticism to which it will, of course, be subjected, and should be generally accepted, as it probably will be, then man

on this continent extends back to the pliocene, and was thus for a long period coeval with the mastodon and elephant. In Europe the mastodon has been found as far back as the miocene, or rather in beds that have usually been considered as miocene, though some geologists are at present disposed to regard them rather as early pliocene. There is good evidence that the troglodytes of Europe knew the mammoth, at least, for rude but characteristic sketches of the huge beast on bone and stone have been found in ancient bone-caves, and, with similar drawings of the horse and other animals, show not only that the early man was well acquainted with the creatures which he represented, but also that he had ideas, crude enough to be sure, but still ideas, of art.

Neither the mastodon nor the elephant was common in New England and but very few remains have been found east of the Hudson river. It seems probable enough that this stream formed a barrier to their eastward extension which they could not surmount. Westward they are found even to the Pacific coast, their remains being more or less abundant in Kentucky, Ohio, Kansas, Missouri and Nebraska, and in Washington Territory, Oregon and California. Big Bone Lick, in Kentucky was a vast cemetery for this gigantic race, and their remains abound in the pliocene and quaternary beds of the trans-Missouri country. The superb specimen discovered by Dr. Koch, and now one of the most imposing fossils in the British Museum, came from Missouri. Numerous specimens of these animals have been found in South America.

The mastodon recently exhumed at Newburg was found in the same swale from which the famous Warren skeleton was taken thirty-four years ago, but about three miles further south. Comparatively little digging has been done as yet, and the hole from which the bones came is only about ten feet by twenty in size. The story of the discovery is briefly as follows: On Saturday the sons of Mr. Kelley were digging a ditch about 100 yards behind the house, partly for the purpose of draining a piece of land on which they had planted some potatoes, and partly to make a barrier to separate the potato field from the pasture which adjoins it. While at work here their tools struck what they supposed to be one of the logs which occur so commonly in the bogs in this region. After getting it out of the ground they hammered it with their spades, breaking it somewhat, and finally decided that it was bone. It was one of the humeri of the mastodon. Further digging brought to light some vertebræ, fragments of the neural spines, etc. The boys did not think much of their discovery, but chanced the same evening to speak of it to Mr. R. W. Genung, who, the next day, with the assistance of some neighbors, got out all that has as yet been unearthed. As soon as they got down a few feet the water gained on them so rapidly that they were obliged to stop digging, and nothing has been done since Sunday toward continuing the search. In fact, just at present they are too busy gathering in the quarters to do much for science. The little room in the barn where the bones are on exhibition, though never crowded, often has a dozen people in it, and as they are coming and going all the time, the daily receipts must reach quite

respectable figure. Mr. Genung has constituted himself showman, and points out the beauties of the specimen in a very enthuiastic and often amusing fashion. An examination of the hole from which the bones were taken shows at the surface a few inches of dark soil, beneath this from eighteen inches to two feet of peat and fine roots, then two feet of black mold interspersed with small fragments of rotten wood. Beneath the black earth is a tough, bluish clay containing a good many gravel stones. The skeleton was found in the black earth above the clay. This clay is said to be underlaid by a fine white sand. No shells were found, nor did my examination of the dirt thrown out reveal any. The skull of the specimen pointed toward the west, and the skeleton is said to have been a good deal disarranged, the hind legs being near the head and some of the ribs being twelve or fifteen feet away from the main congregation of bones.

Ninety-two bones are said to have been discovered, and this number no doubt includes all the fragments picked up. Of the vertebræ there are but eleven having the center preserved, viz. : One cervical, four dorsals, four lumbars, and two caudals. There are besides these a few spines and neural arches. The vertebræ are most of them a great deal decomposed, as they were probably nearer the surface of the ground than most of the other bones. The atlas, however, is perfect. One scapula is present and in good condition. The pelvis is missing, as are most of the meta-carpals, meta-tarsals and phalanges. Both astragali are present and one calcanum and quite a number of the carpal and tarsal bones, but not enough to make up a perfect foot. All the bones not specially mentioned are present. The specimen appears to be the common *Mastodon giganteus* of Cuvier, and is fully adult, as is shown by the condition of the bones and the wear of the teeth. It is not a very large specimen but most of the bones are well preserved. They are not all mineralized, various reports to the contrary notwithstanding.

[*N. Y. World.*

FOSSIL SPONGES.

S. S. Wallace has examined the geodes found in the Keokuk (Lower Carboniferous) limestone over a great area in the Upper Mississippi valley. They are shells of chalcedonic silica of from a few lines to two feet in diameter, sometimes empty, but at other times filled with agate, crystalline quartz, or calcite, and have long been suspected to be organic in origin. Wallace has confirmed this view, and shows them to have been castes left by the decay of sponges, of which they often bear the outward markings. He has described several species which he refers to a new genus, *Biopalla*. These sponges are seen to have grown in some cases over and around projecting masses of rock, and, in one case, within a large crinoidal column, which had been split open by the growth of the sponge.—*Annual Record of Science and Industry.*

ARCHÆOLOGY.

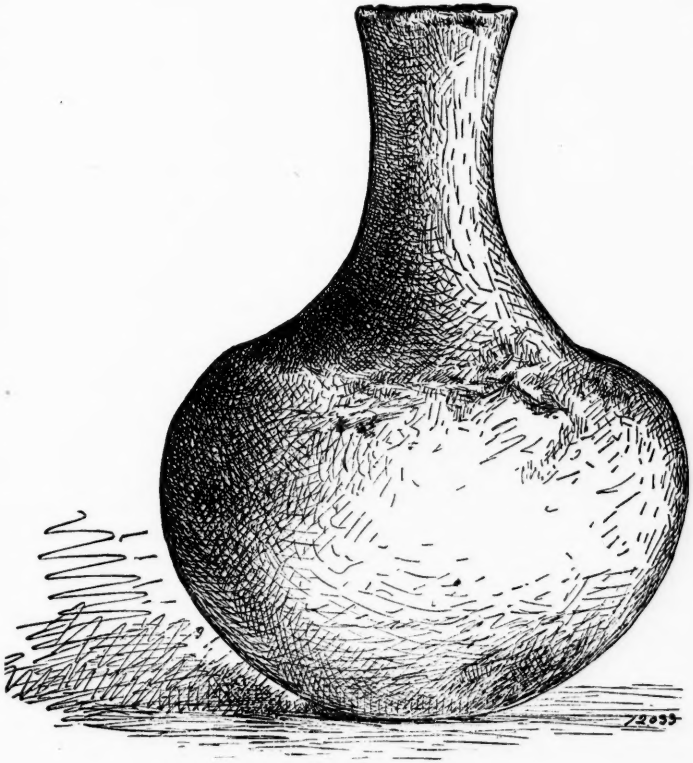
ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F. W. PUTNAM, PEABODY MUSEUM.

(*Concluded.*)

Scattered irregularly within the inclosure are nearly one hundred more or less. defined circular ridges of earth, which are from a few inches to a little over 3 feet in height, and of diameters varying from 10 to 50 feet. The best defined of these

Fig. 37.



Jar from grave, Burial Mound within Earthwork. ½.

little mounds was that marked *B* on the map. An examination of these numerous low mounds, or rather earth rings, as there could generally be traced a central depression, soon convinced me that I had before me the remains of the dwellings

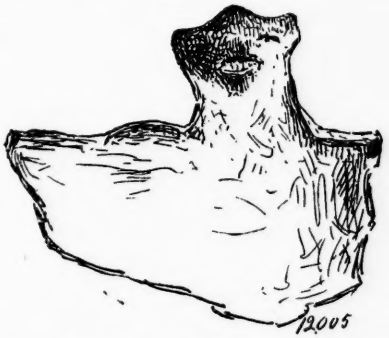
Fig. 38.

Jar from grave, Burial Mound within Earthwork. ½

of the people who had erected the large mound, made the earthen embankment, buried their dead in the stone graves, and lived in this fortified town, as I now feel I have a right to designate it.

Nineteen of the best defined of these earth circles were carefully explored with very gratifying results, and proved to my satisfaction that the ridges were formed by the decay of the walls of a circular dwelling, about which had accumulated, during its occupancy, such materials as would naturally form the sweepings and refuse of a dwelling of a people no further advanced towards civilization than were these Mound-builders of the Cumberland valley. These houses had probably consisted of a frail circular structure, the decay of which would only leave a slight elevation, the formation of the ridge being assisted by the refuse from the house.

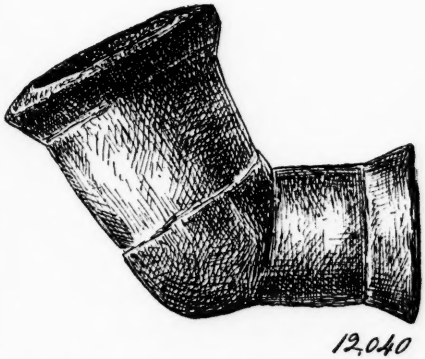
Fig. 39.



Fragments of Pottery from grave, Burial Mound within Earthwork. Natural size.

After the recent soil within the ridges had been removed, hard floors were discovered, upon which fires had been made; while in the dirt forming the ridges, were found fragments of pottery; broken and perfect implements of stone, several discoidal stones, most of which were made of limestone; bones and teeth of animals, charcoal, etc.

Fig. 40.



Pipe made of Slate, from grave, Burial Mound within Earthwork Natural size.

On removing the hardened and burnt earth forming the floors of the houses, and at a depth of from one and a half to three feet, small stone graves were found in eleven of the nineteen circles that were carefully examined. These graves were in every case those of children, and were from one foot to four feet in length. In some the bones were entirely decayed, in others a few of the more solid parts of the skeleton such as the shafts of the long bones, the central parts of the vertebræ, and fragments of the crania were preserved.

The tibiæ of one young child in particular are worthy of remark from their extreme thickness and great curvature. These tibiæ of children are not in the least flattened, though some of the tibiæ of adults from the burial mound are.

These children's graves were found at one side of the center of the house, and generally, it was noticed, that a fire had been built over the spot, as shown by the

Fig. 41. Pipe carved from Steatite, from Burial Mound within Earthwork.

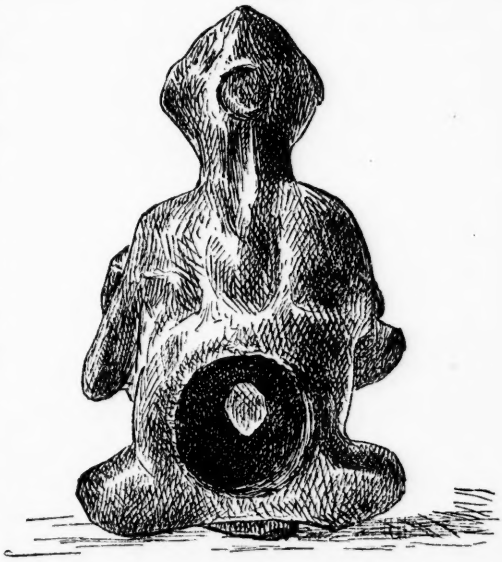
Fig. 42. Side view of figure 41.

burnt earth and charcoal. From them were obtained the best specimens of pottery found within the earthwork, with shell beads, pearls, and polished stones of natural forms, etc., which were probably playthings. In several of the smaller graves were the metacarpal bones of birds, which may have been given to the children to aid the teeth in perforating the gums, as is stated to be the custom among some of the present Indians.

Three small discoidal stones were picked up in the ridges of as many different houses, and one other was found on the hard floor, while still another was discovered in the burnt earth over a child's grave.

In the dirt forming the ridge of the house designated as No. 3 in my notes, and under the floor of which graves were not found, was a fragment of thick pottery (Fig. 44) with the impression of a closely woven fabric of coarse threads. Near this was taken out a bowl (12046) with rudely scalloped edges, of which figure 45 is a representation. From the same place was also taken a rude celt (Fig. 46), made of sandstone (12047).

Fig. 43.

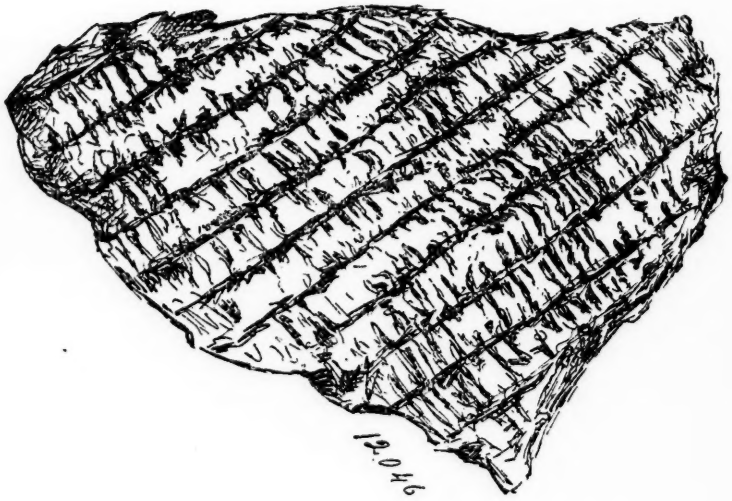


Back view of figure 41.

Under the floor of one of the houses was a small grave containing the remains of the bones of two children, and with them the dish (12072), of which figure 47 is a drawing. No other article was found in this grave, over which a fire had been made, and in the ashes were burnt animal bones, a discoidal stone and several fragments of pottery. Within the area covered by another house, three burials had taken place, and from these graves were obtained two earthen vessels, a discoidal stone, a dish, and a few shell beads.

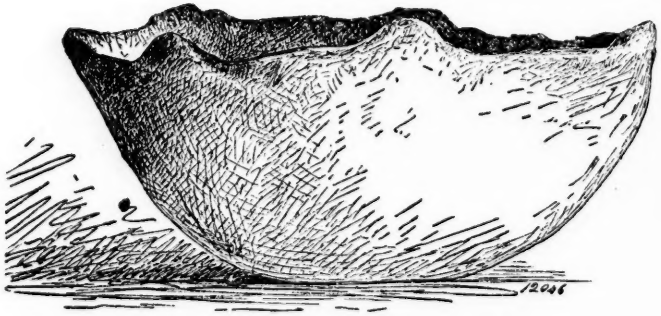
Three other houses contained graves of children in which were found several articles worthy of note, and evidently of considerable value. Under the floor of one of these houses, two graves were discovered, one of which was made simply by placing two stones about eight inches apart, and was without the usual pavement at the bottom, or the covering and end stones. This contained the remains

Fig. 44.



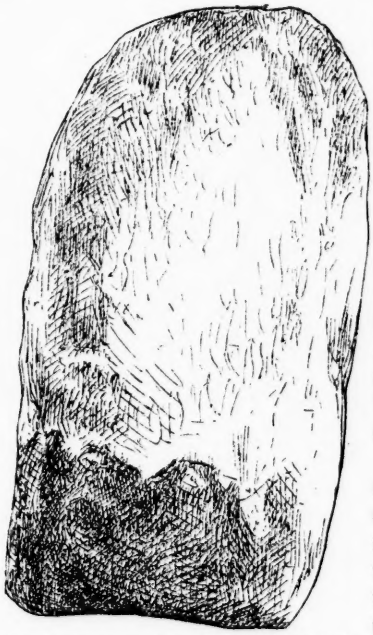
Fragment of Pottery from refuse of a House within Earthwork. Natural size.

Fig. 45.



Bowl from refuse of a house within Earthwork. ½.

Fig. 46.



Celt of Sandstone from ridge of House within Earthwork. Natural size.

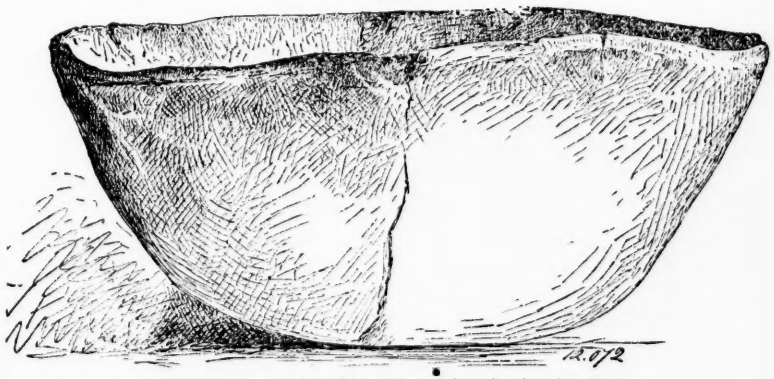
of an infant buried in ashes, though the bones were not burnt, and two broken vessels of ordinary form.

In the other grave was a similar vessel (12062, Fig. 48), an awl or pointed implement of bone (Fig. 49), and another made of deer's horn, the leg bone and a vertebra of a bird, and five shells of *Unio*.

Another house, located near the large mound, contained two graves, in one of which was found a water jar mounted on three hollow legs, the cavities of which connect with the body of the jar, while the cross bars between them are solid. This jar (12093) is shown, of one-half its diameter, in figure 50.

The other grave in this house was remarkably rich in relics, and contained an earthen pot (12086), a bone of an animal (12087), the shell of a *Unio* (12088), two large shells of *Busycon* (12089) from the Southern Atlantic coast, from which the columella had been removed and a large lot of small shell beads (12091), of

Fig. 47.



Dish from grave of a child in a House within Earthwork. ½.

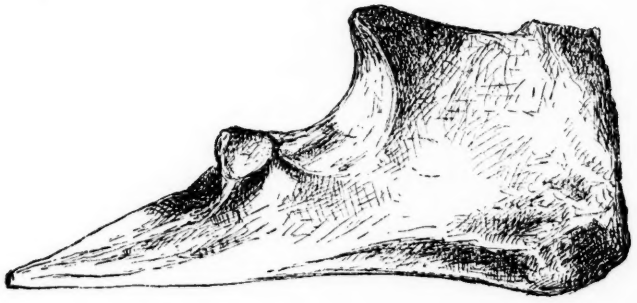
which six hundred and fifty were collected and many more were in fragments. These beads would have formed a chain several feet in length, as one hundred of them measure eighteen inches. With these shell beads were seven perforated pearls (12092) of large size, among them one which is nearly one-half an inch in diameter; also several handsome pebbles (12090) of quartz, chalcedony, etc., and a piece of the stem of a fossil crinoid.

Fig. 48.

Pot from grave of child in a House within the Earth work. ½.

The last of the houses examined, which was also located near the large mound, contained the graves of an infant and of two other children. In the grave of the infant, the only article found was an earthen pot (12101), represented by figure 51. The second grave contained a dish (12096), and the small pot (12095) with ornamented edges, shown in figure 52. The third grave was remarkable for the three well-made articles of pottery which it contained. These are represented, of one-half their diameter, by figures 53, 54, and 55. The pot shown by figure 53, is a symmetrical vessel, with deeply scalloped edge and with a projecting portion under each point of the scallop. Figure 54 is a well executed design of a duck shaped bowl, while figure 55

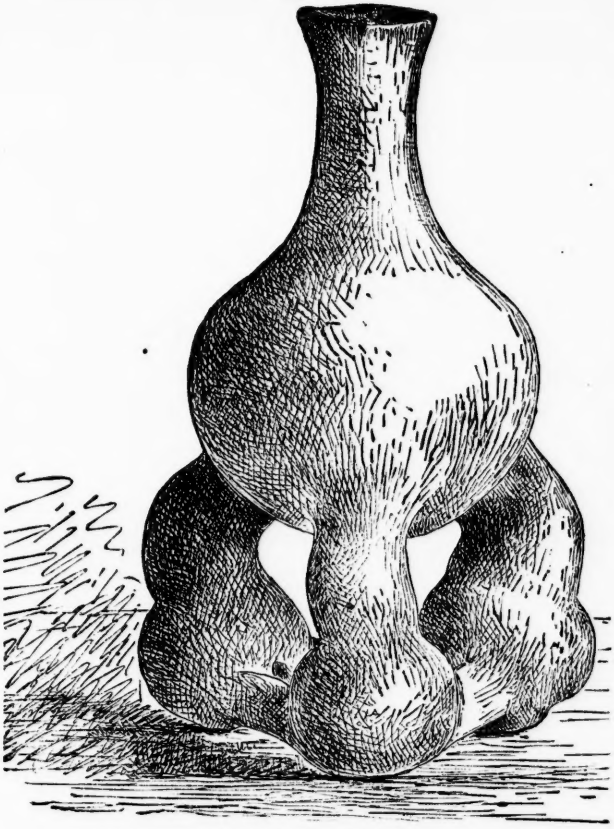
Fig. 49.



Implement of Bone, from grave of a child in a House within Earthwork.

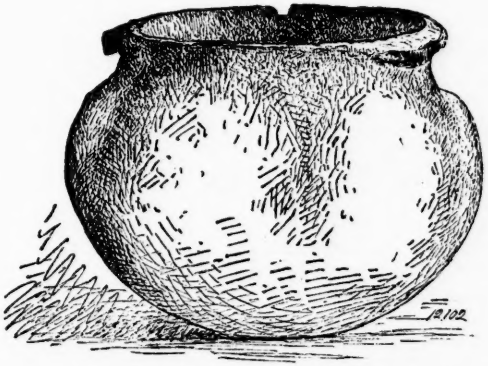
represents a water jar in the form of a bear. This last is the only article of pottery obtained within the inclosure at Greenwood that was not of the ordinary blue gray color, like the majority of the pottery from Tennessee, Missouri, etc. The surface of this jar is of a yellowish color, and on this had been painted a number of concentric figures, which were perfectly apparent when

Fig. 50.



Jar from grave of a child in a House within Earthwork. ½.

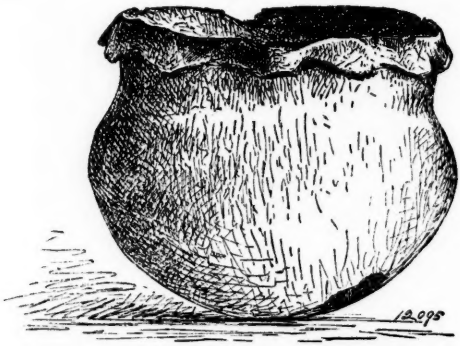
Fig. 51.



Pot from grave of a child in a House within Earthwork. ½.

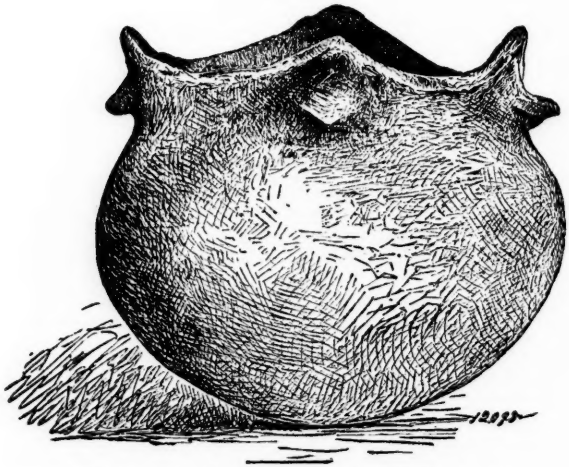
the jar was first removed from the grave, but as they had not been burnt in, they scaled off in drying and are now only faintly indicated. This interesting jar, with others that are here figured, is evidence of the high attainments of this ancient people in the ceramic art, and shows the development reached in native art by people who worked in copper, carved in stone and shell, moulded in clay, wove fabrics of several kinds, cultivated maize, lived in walled, or fortified towns, buried their dead in an extended posture, generally in stone graves, and erected the large mounds of the Cumberland valley, from which they are now known as the Mound-builders.

Fig. 52.

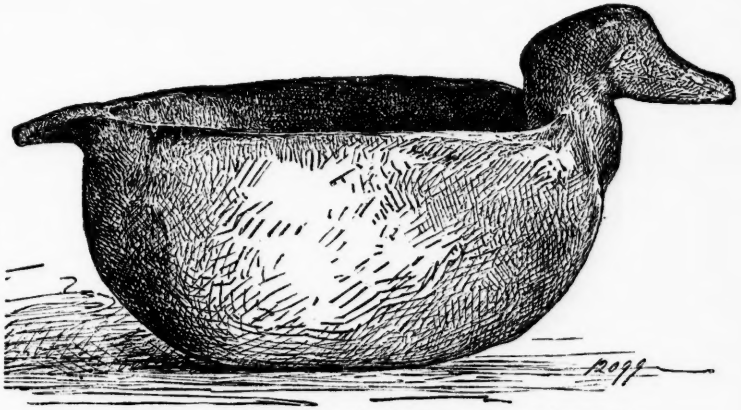


Pot from grave of a child in a House within Earthwork. ⅛.

Fig. 53.



Pot from grave of a child in a House within Earthwork. ½



Duck-shaped Dish from grave of a child in a House within Earthwork. ½.

Fig. 55.

Fig. 55. Painted Jar, from grave of a child in a House within Earthwork. ½.

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

(*Continued.*)

It is a well known fact that racial characteristics are very persistent in all peoples, and give them an ethnical cast, utterly unmodifiable so long as racial purity is maintained. It is well known also that mental characteristics, all moral or emotional peculiarities, are engrafted upon, formed and controlled by physical characteristics, and that the two are inseparable, co-ordinate and persistent. This permanence and tenacity of ethnical features, is due to the long practice of peculiar habits, amid peculiar circumstances and environments, during the development of the species in what we are pleased to call "pre-historic times."

With most races of the human family, this period was during the incalculable æons geologically known as the tertiary and quartenary periods. This was undoubtedly the childhood of the species—the impressible period. We are only too well aware how impressible the young, the child of our species is, and how permanent and potent for the moulding of all after life are those impressions. Believing that the child is the anologue of the growth of the species, that the individual of every animal kind in its physical and mental development passes through the same stages in its growth, as those which marked the eras of the development of the species, we cannot but conclude that the life histories of the two are strictly analogous, and that as a result the peculiarities of races, physical and mental, are the product of impressions received and habits formed during the infancy and childhood of mankind. Then, external influences and internal effects co-operated to develop the phenomena of organziation peculiar to each race. Those impressions manifest themselves in physical and physiological peculiarities, habits of thought, feeling, morals and beliefs; in the customs of the common life of the individual, the family and the people, in society, government, etc., as well as the casts and modifications given to language and religion, and in all that is at all peculiar or indigenous to a people. Language and religion are not included among the special peculiarities, because these are but rarely indigenous to a race, but are usually imposed by foreign, conquering peoples and are consequently arbitrary; and yet when so imposed are always modified by the customs and mental habits of the people before complete adoption. To most ethnical phenomena, however, this rule does not apply, and under the coercion of unwelcome innovation, many races have gone down to utter extermination before the forcible imposition of things so foreign to everything in their lives that they were

incapable of adaptation to them. This is noticed in races which have, as they always do under such circumstances, on the removal or relaxation of coercing power, reverted to their original, natural habits and customs, in which they are most happy and prosperous. This is exemplified also in the individual, who returns to the habits of childhood as most natural, after having lived to him, an artificial life which differed from it, and this is equally true of races. Those things to which a race has been accustomed for ages, it matters not what they are, are to them the embodiment of all that is perfect and natural, and all that is foreign to them or their experience is most unnatural, strange, repulsive and even ludicrous. It is the same spirit in individuals which dubs the habits or tastes of others as "queer," merely because those peculiarities are foreign to their own experience, and not suspecting that they are "queer" to others in turn. We have heard of savage and degraded people who looked with pity and wonder upon Europeans because of their strange customs, ludicrous ways and white skins. It appears then that the value of all things pertaining to man is only comparative, be he savage or civilized, and depends only upon the education and preferences of a people. Preference for tribal, indigenous customs, etc., becomes a passionate attachment, things to which they are accustomed being endeared by association and most conducive, with them, to happiness and prosperity. The practice of habits or customs elevates them in time into a second nature, and anything in the way of a forcible alteration of them assumes the potency of a disastrous revolution which brings only evil and misery.

Here we would make the first rule of conduct, which must be named the *negative duty* of the higher or stronger nations, to the lower or weaker; *i. e.*, that no race has any moral or other right to interfere with the habits, customs, government, etc., of any other race and impose upon it things strange and repulsive, merely because the stronger race happens to be attached to those things and thinks them best. Civilized nations should not attempt to force their own customs, institutions or government upon other peoples, whether savage or not, because they are differently, perhaps inferiorly constituted, and on account of such difference or inferiority are incapable of understanding, appreciating or adapting themselves to civilized institutions. Every people, savage or civilized, understands and enjoy only the things to which it is accustomed. But too little account has been taken of this principle by European nations, who, in their own ignorance and conceit, imagine that because certain institutions are theirs, and are useful and agreeable to them, that they should be adopted by all other peoples indiscriminately, irrespective of the possibility of different tastes, capacities and peculiarities. Some of them have partially discovered this mistake in their dealings with Asiatic people, whose modes of thought, etc., are as different from European as that of one species of animal from another.

The different altitudes of intelligence and mental capacity of various races, have much to do with the comparative value of institutions. In the matter of the form of government, it does not hold that because the Republican is that

which is best for the highest and most intelligent people, that it can be applied to all races, irrespective of intellectual capacity. For the fact is, that the earliest, the primitive form, *i. e.*, the patriarchal and tribal, is yet the best for simple and savage people. The forms of government are graded in corresponding ratio to the development and stages of intelligence of races, through various appropriate modifications, from the patriarchal up to the republican. As man still progresses and unfolds, we believe a yet higher form will be developed as he becomes less and less brutal, more intelligent and more capable of self control. The higher classes of Indo-European races have outgrown the tribal and even the monarchical forms, but the masses are yet incapable of the merest self control, thus keeping the average low, while many of the most degraded classes, even of the Anglo-Saxon blood, are not above the patriarchal and despotic. The right to vote is to them a mere novelty—they do not understand it. The savage does not comprehend the higher, the European forms, and will rarely flourish under them, unless with a compromise government. The simplicity of the tribal and despotic system is best suited to his childish and primitive cast of thought, and he must be let await intellectual development and civilization before being called upon to adopt and flourish under anything higher. The same may be said of customs and domestic institutions.

The love of a people for their *racial* government—their own form, their own rulers—is proverbial, and is another and humane reason why it should not be interfered with. This love of country and government has led to the universal willingness amongst men to fight and die for it, and this devotion is dignified amongst the higher nations by the name of *patriotism*. In addition to natural affection for their country, all men have a strong intuition that racial rule is *right*, and control by a foreign power is a wrong that cannot be borne. The imposition of foreign rule has been the most prolific cause of bloodshed and misery the world has ever known; for men fight more savagely in defense of home, country, racial customs and government than for any other cause. The finest heroism has been exhibited by patriots, as well as the most wonderful examples of unmurmuring endurance of suffering and hardship. All these are because foreign rule is naturally odious to all people, even when it is accompanied by greater security to life and property. Patriotism is rarely developed for a government foreign to a race and never of any depth; and a good opportunity to throw off the yoke of the usurper, and reinstate their own rulers and gain racial independence, is never allowed to pass without an uprising, so long as the original racial characteristics remain in any strength amongst a subjugated people. All people have an inherent intuition that independence and autonomy are birthrights in a race, and the recognition of this feeling as a living, moral principle of right amongst nations would lead to untold happiness and prevent untold misery, both to the conquering race and the conquered. Let the nations and races permit each other to govern themselves, to please themselves, and who can estimate the happiness which will spring from the adoption of the law, when all people will be free from the fear of foreign con-

quest. There will be little or no war and consequent absence of the miseries springing therefrom; there will be few armies and absence of oppressive taxes to support them, and peace will promote industry and wealth.

Besides the ethnical and humaritarian objections to the policy of foreign conquest by any nation or race, there is also that of common moral right. As before remarked, compared with laws and actions between individuals, and judged according to the common rules of right, the conquest of one race by another is simply highway robbery, with the additional crime of slavery. The robber of men merely takes his neighbor's money or goods, and, if he does not resist, rarely murders him. But the conquering nation, not content with taking and appropriating the territory belonging by right to another race, robs that race of freedom as well and places ownership over both person and property. The people are held as chattels by the conquerers, practical if not nominal slaves. They are not of the conquering race and have no part or voice in ruling their own country. Citizenship, when bestowed upon them, amounts to nothing, for governing power or voice in government is kept from them, while under their own rule they were part of their nation had, a voice in its affairs and an interest in the general ownership of the soil. Under foreign rule, however, none of these rights are recognized or prevail, because such recognition would naturally imperil the ruling power. The soil belongs to the conquering rule, and the conquered people hold and cultivate it merely for the benefit of the conqueror. They are slaves attached to the soil; their persons, their labor, their property belonging to another.

Passing now, for a moment, from the negative duty of the greater to the lesser nations—of all races to each other—let us introduce another, the *positive* duty, especially as applied to the civilized nations in their care for semi-civilized, barbarous and savage people. This duty is a positive one, as opposed to the negative duty of non-interference, inasmuch as it requires active interposition in the affairs of wild or cruel people, *merely* to (1st) prevent and restrain them from murder, cruelty, slavery and oppression, and (2d) to educate them in the elements and principles of civilization and Christianity. The two duties do not, as may at first appear, negative each other, but are mutually helpful.

Under the first head of the positive duty, there would be direct interference by force of arms by civilized nations for the prevention of cruelty amongst savage people. No matter what the source of cruelty or its form, whether from customs, religion or despotic government, it is productive of misery and should be prevented (except when inflicted as a punishment for actual crime,) at any cost short of cruelty in the enforcement of the protest, and this for the sake merely of humanity and common brotherhood. Under the second head, teachers and missionaries should be maintained by civilized countries, amongst ignorant and savage peoples, to instruct and educate them in the knowledge of the world, science and Christianity. But the education must not be compulsory beyond the forcible maintenance of teachers amongst such people.

The right to interfere to prevent cruelty is, of course a common one, a duty

of one man or nation to another, and if the giving of power and civilization, of mental and moral elevation to a nation, means anything, it means that they should be employed for the benefit, the promotion of the good of people less fortunate. England, it is true, makes this claim as her right to subject wild and savage people to her political rule; but while she protects them she does not educate or elevate them, and, besides, she violates the first law of right between races in depriving the weaker of autonomy, and imposing her own rule—in making of their country British territory. This is a crime, and *she inflicts* bloodshed and misery in order to its commission. Her political rule is absolutely unnecessary and is hurtful to the people subjugated. Interference merely to the extent of preventing cruelty and of educating them, letting them govern themselves, to please themselves so long as they abstain from cruelty, would accomplish the same benefits to her trade and much more good to the natives. But British ambition could not be satisfied, or British pockets be filled so rapidly, and "there's the rub."

This surveillance of civilized, Christian nations over the savage, weak and ignorant, must be in the nature of a *civilizing protectorate*, its object to shelter and protect them from themselves and others, and to educate and elevate them, that they may themselves, in time, become civilizers in turn. By the establishment of this principle many a picturesque and interesting people would be preserved in prosperity and happiness, to do good and be blessings among nations. All the bloodshed and misery attendant upon those destructive wars of conquest would be avoided, and patriotic, racial rule prevail everywhere. It is improbable that any people would resist, to any serious extent, the teaching and enforcing of mercy and kindness by a stronger power, when once the purpose of interference was understood, and that it was not political conquest. The superior power would teach the inferior self government and erect only racial rulers to control, and this, with education of the people and the check put upon cruelty, would contribute as nothing else could, to the health and development of physical, mental and moral life of a high type, and could only result in happiness and good. The achievement of these results would of course, be slow; the lifetime of generations might be necessary before permanent benefit could be guaranteed to a people and they be left to themselves, the rate of progress varying, of course, with the capacity of races for receiving instruction. The education would, also, not overthrow native and domestic institutions, but merely modify and elevate them.

The curse of most savage countries is witchcraft, fetich worship and superstitions, which are inseparably accompanied by much cruelty and suffering, both physical and mental. Overpowering fears haunt the poor savage by day and terrors by night without cessation, such as the people of civilized lands know nothing of. It is not always the fear of physical death or torture that makes him miserable, but even when not under persecution, real or imagined, he has ever present with him the dread of cursings and witchings or terrible calamities, the like of which his imagination cannot picture to him. All people have passed through the long stage of the rule of the terrorism of superstition, and its mark is left upon every race. Superstitions shorn of its terrors, perhaps, still survives amongst all,

even the highest of races, as manifested in the belief in signs, omens, and in other forms. It is the first inceptive belief in the supernatural, and from which the religions of all races have been developed. But in the lowest races it is attended with great cruelty and misery, and the duty of civilized, Christian nations is plainly in the path of elevating and Christianizing the poor savage, in order to the lifting of his soul out of the groveling miseries of his superstitions into the light. Civilization will rid him of his belief in and fear of witchcraft and other ill powers, and evangelization will furnish him with a religion at once elevating and merciful. He will be taught that the ordinary and extraordinary phenomena of nature are not due to spirits, mostly evil, and which can do him only harm, but by knowing the true causes he will come to love and admire what he formerly feared and hated.

In the matter of the evangelization of savages, the Christian nations have a delicate duty upon their hands in regard to missionary effort and religious questions. A religion must not be *forced* upon any people, any more than anything else foreign to them, merely because a stronger nation happens to believe it to be true. Like the teachers of civilization, missionaries of Christianity must be maintained by force, if need be, in savage countries, but the acceptance of their teachings must be optional with the people, and be let grow upon them as they understand and appreciate them. Christian nations, having faith in their religion and being furnished with every proof of its truth which the highest intellectuality can adduce in its favor, are in duty bound, by the nature and teachings of that religion, to propagate it for the good of mankind and the salvation of the world. It is their duty to endeavor to make of savage people better men, and save their souls, and to that end missionaries are sent amongst them The missionary system is still the best for the promotion of the work; but it has become an experimental fact that education and a semi-civilization at least, must precede and prepare the way for a perfect and saving acceptance of Christian teachings. The mental capacity of the savage must be enlarged, and his moral faculties developed, before he can understand and appreciate the principles of Christianity. This has been demonstrated by the sad experience of hundreds of faithful missionaries, who have gone down with broken hearts to the grave, because discovering too late that the wily savage, deceptive by nature, has merely pretended to the possession of the Christian graces, which the missionary pictured to him and desired him to have. He has played the part of the heartless hypocrite, because good actions and words pleased his good friend, the missionary, and the latter, credulous because anxious and desirous, believed the savage truly converted, but at the last found that he had been played upon and deceived. The cause of this unfortunate condition of affairs, only too general in the missionary world, lies in the fact that the mind of the savage is incapable of receiving the higher teachings of Christianity, or to comprehend them, until trained and developed to a certain capacity. The plan of educating before attempting to Christianize, is now becoming more and more the working system of missionary effort, and as such is productive of greater and unmistakable success. The school for children

and the adults who will accept teaching, is now the entering wedge, and conversion and evangelization follow as an apparently natural sequence.

The history of missionary effort amongst savages can, in fact, give us the key to, and illustrate, the better system of dealing with independent and wild people. The true missionary never interferes with politics or customs, except to prevent by his teachings and persuasions, the practice of cruelties, and much good he has done in this way. Civilizing nations should deal with wild peoples in the same way, *i. e.*, by becoming the missionaries of civilization and Christianity, and practicing non-interference in politics and customs, *except* to prevent cruelty. The people would probably accept of their ministrations eagerly, when convinced of them being only for their good and of the good faith of the missionary nation.

It can scarcely be questioned that the time has fully come when nations should lay aside all selfishness and deal more honestly and justly with each other. But the so-called practical, the main objection to be made to the principle here proposed is, of course, that "it would not pay" the nation endeavoring to inaugurate and put it in practice. The immediate expenditure and outlay on the part of the government, or private enterprise of a people attempting the establishment of the system would, of course, be considerable, and would not be returned, at least in direct revenue. But yet in time, the benefits arising from trade would be just as great, if not greater, than if political supremacy had been first established, which, with the forcible maintenance necessary afterward, is itself a most expensive luxury to any nation. In the case of Great Britain and her acquisitions, we cannot but believe that she would have expended sufficiently less of blood and treasure by merely maintaining small armies for the prevention of cruelties, etc., in those conquered countries, to have more than compensated for the cost of original conquest, the suppression of righteous rebellions, the carrying on of English government and law, and trade be what it is, or better, without forcing. All that has been gained over and above the cost of governing, in revenue, commercial advantage or glory, is not a sufficient compensation for the cost of conquest in misery to British subjects, blood and money. It would have been much cheaper to have established and maintained a civilizing protectorate, under which trade could have been carried on with fully as much success and safety, and more honestly, and have left the governing of the people to themselves, who would have done it better. There would necessarily have been little or no resistance, for freedom and independence would not have been interfered with. The task of governing people for which Europeans are totally unfitted, would have devolved upon the people themselves, who would have had all the labor, difficulty and responsibility. As to revenue, we find England this year in the extremity of appropriating funds from the home treasury, for the maintenance of the Indian army and government, the taxes of that vast and populous region, burdensome as they are to the people, not being sufficient to meet the expense of occupation and public improvements, the latter, as railroads, etc., being necessary for the efficiency of military control. The working of all the departments of the government of India, requires an army of men, military and civil, and all

this, with its endless burdensomeness and failure and disappointment, with its needless expenditures and follies, its crimes and wrongs to natives, might be swept away, by the adoption of racial rule, and British commerce not suffer in the least. The entire revenue does not now meet the expenses of ruling, and all the satisfaction or reward to be gotten out of English possession seems to be the glory of British dominion!; a very poor return indeed for all the expenditure for conquest and the cost of subduing such righteous rebellions as the Mutiny, with their attendant miseries to both conquerors and conquered.

The annoyances and difficulties of governing nations and peoples to whom the conquerors are ethnical strangers and antithetical at every point of mind and character, has been demonstrated by the experience of European nations with Asiatics. Under the philanthropic system all these difficulties would be turned over *in toto* to the native rulers, who, even with less intellectual capacity, could do the same work with more ease and more satisfaction to the people, than foreigners. The intuitive agreement and understanding between people and rulers when of the same race, is at once natural and obvious. The objection that may be made to the *quality* of native government, when compared with the higher European forms, does not stand, because the native government will necessarily be that form to which the customs and capacity of the people conform, and which they can alone understand. A higher form may be better for a people of higher intelligence, but for those of lower intelligence the lower systems are better. The same may be said of systems of laws. England, for instance, persists in the imposition of her own laws upon people whose needs are utterly misunderstood, and the application to them of her laws works mischief and injury. But instead of learning to appreciate this by perpetual failure to administer justice, the stupidity still goes on. How long will nations be in learning that the laws and government which each race makes for itself, are the best suited to the circumstances, customs, intelligence and character of that people, whoever they are, are the best understood and productive of the most good! and that the same government *cannot* be applied to another race with success and benefit.

(*To be concluded.*)

Professors Ayrton and Perry, of the College of Engineering, Tokio, Japan, communicate to the *Philosophical Magazine* a short note, proposing the hypothesis that the phenomena of earth currents, terrestrial magnetism, and atmospheric electricity are due to the fact that the earth is an electrified condenser, whose capacity or potential is continually changing on account of its rotation and its annual orbital motion, the successive cooling and warming of the air, the formation of clouds and rain, etc., etc. These changes produce electric currents tending always to restore the equilibrium, whence follow the phenomena in question. They suggest that observations of atmospheric electricity may be used to predict atmospheric changes.

GEOGRAPHICAL NOTES.

GERHARD ROHLF'S AFRICAN EXPEDITION.

Probably never before in the history of African exploration have so many different expeditions been simultaneously engaged in penetrating the interior of the "Dark Continent" as at the present time, and if the success of the explorers prove at all equal to their exertions the last white spot will soon disappear from the map of Africa. A summary of the various expeditions now on the march must therefore be of interest to all readers concerned with the geographical research of our globe.

The only expedition which has taken the Mediterranean coast for its starting point is the one sent out by the African Society at Berlin, under the command of the well known Gerhard Rohlfs. The latest news from this explorer is as follows: The expedition left Tripolis on December 18, 1878, consisting of three Europeans, two German servants, thirteen native followers and twenty-two camels, and arrived at the oasis of Sokna, which lies some 600 kilometers south-east from Tripolis, at the foot of the Black Mountains, on January 24. After a six week's stay in camp, waiting for the German Emperor's presents for the Sultan of Wadai, Rohlfs continued the march due east to Jalo, distant eighty German miles, where he arrived in the first week of April. He traveled to this place by a new route, and visited on the way two new oases, which were previously unknown. He will now have to cross a tract of sandhills, eight days across, in order to reach the oasis of Kufarah, which lies seven camel's marches or eighty kilometers, due south of Jalo, and has never before been visited by a European. He had not yet succeeded in obtaining guides, as none were willing to enter the service of Christians, and he may have to buy slaves acquainted with the road. From Kufarah he intends to push on south to Wadai, and thence to the great bend of the Congo.

EXPEDITION FROM THE EAST COAST.

Ever since the days of Burton, Speke and Grant the east coast of Africa, and especially the island of Zanzibar, has been the favorite starting point of exploring expeditions for the interior. Cameron and Stanley both commenced their memorable journeys there. At present there are also several expeditions which have chosen Zanzibar as their base. The Belgian expedition, sent out by the International African Association, under the presidency of the King of Belgium, has thus far been conspicuous for the ill luck that has attended its march.

Two of its members, Captains Crespel and Maes, died soon after arriving at Zanzibar. Lieutenant Cambier and Marno, the Italian traveler, then made a preliminary expedition as far as Mpwapwa, on the road to Lake Tanganyika. They left Saadani January 21, and returned to the coast March 5. Marno then returned to Egypt on account of some disagreement, and Cambier took command. On July 4 last year he left Bagamoyo for the interior accompanied by Dr. Dutrieux, who has resided at Cairo for five years as physician, and 500 native porters. On the 23d the expedition reached Mwomero, when 325 of the porters deserted with a great amount of baggage. Cambier went on with the rest to Mpwapwa, which he reached August 8, and there waited till Lieutenant Wanthier, another member, arrived from the coast with 360 new porters. Cambier then pushed ahead to Tabora, the Arab capital of Unyanyembe, while his associates followed slowly through Ugogo. On December 19, Wanthier died of dysentery at Hekungu, near Lake Chaya, but Dr. Dutrieux succeeded in joining Cambier at Tabora, where the last advices report the expedition to be waiting for the end of the rainy season before going on to Lake Tanganyika. Meanwhile Captain Popelin, of the Belgian general staff, and Dr. Van Heneel have left Brussels in April last to join and reinforce this unfortunate expedition. There is a belief that Stanley is acting in the interest of the Belgian International Association and that he will either organize a new expedition for this society or accompany the same as leader or interpreter. The general opinion, however, is that his ultimate destination will again be the Congo. He has brought with him a steam launch and a large cutter as well as a great quantity of pierced iron plates for the protection of the boats while passing through hostile regions.

THE ENGLISH EXPEDITION—DEATH OF KEITH JOHNSTONE.—Dr. Kirk, the English Consul General at Zanzibar, writes to his government that Mr. Keith Johnstone, the leader of the English expedition to explore the head of Lake Nyassa, died of dysentery on the 28th of June at Berobero, 130 miles inland from Dar-es-Salaam. [Mr. Keith Johnstone was the son of the eminent English cartographer. He was selected as the leader of the expedition sent out by the Royal Geographical Society with the African Exploration Fund. He left England in November last and reached Zanzibar January 5. He first made a short expedition to the Usambara Mountains, north of the Kingain River, and visited Fuga, the capital of that country. He returned to Zanzibar in April, but was prevented from beginning his expedition by exceptionally heavy rains and swollen streams. On May 15, however, he started with 138 followers and crossed over to Dar-es-Salaam, on the mainland, in the Sultan's steamer Star. The object of his expedition was to reach the north end of Lake Nyassa by a new and direct route from the coast, and then explore the unknown tract between that lake and the south end of Tanganyika. Letters from Zanzibar up to the 2d of June reported the final start of the explorer and his party from Dar es-Salaam on the 18th of May. The expedition was to pass up the valley of the Lufigi and its affluents to Ubena, and thence to Nyassa and Tanganyika. Mr. Johnstone was ac-

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companied by Mr. Thomson, as geologist, and Chulma, Livingstone's favorite companion, was among his followers. Letters from Zanzibar, dated the 26th of June, reported that Mr. Keith Johnstone, when last heard of, had been making successful progress, having reached a village on the border of a deserted country through which he would have to travel for six days without meeting cultivation. He was then occupied in collecting food to take the party across this desert to Beho-beho, a populous village in Kutu, not far from the Ruaha, one of the two rivers which unite to form the Lufigi. Up to the time of writing he had experienced no difficulty from his porters, but had been delayed by the frequent and heavy rains, which this year have continued longer than usual. Two days later the explorer appears to have succumbed to dysentery, brought on by the miasma produced by the rains.] The expedition will be continued by Mr. Thomson.

A FRENCH EXPEDITION.—A third explorer who has started from Zanzibar is the French Abbe Michel Alexandre Debaize, who has been sent out by the French government with an appropriation of $20,000. In contrast to the Belgians the Abbe has so far been highly successful. He left Marseilles on April 21 and organized his expedition at Zanzibar in less than two months. On July 25 he left the coast and after passing the Belgian expedition on the way, he reached Tabora October 2, without losing any baggage or a single one of his 400 men. On the 16th he passed through Kroikuru, and on April 2 he arrived at Ujiji, on Lake Tanganyika, 250 days from the coast. Stanley, however, when searching for Livingstone, made the same distance, with a detour, in 235 days. Debaize now intends to establish a station at the north end of the lake, which he leaves in charge of reliable servants, while he goes on to the Congo in order to found a second station, with his remaining goods, at the mouth of the Aruwimi. With these two bases of supplies he then proposes to explore the great unknown regions between the north end of the Tanganyika the Congo, the Aruwimi and the south end of the Muta Nzige Lake, which now form a white spot on our maps.

MISSIONARY EXPEDITIONS.—Several missionary expeditions have also started from the east coast. The London Missionary Society last year sent out the Rev. Messrs. Thomson and Hutley, with Mr. Hoar as scientific member, to Lake Tanganyika. They succeeded in reaching Ujiji on August 23d, and established a station on Kigoma Bay, three miles distant. In October, however, Rev. Thomson died of sunstroke, and the Rev. Penrose, of the Church Missionary Society, while on the way to the Tanganyika, was attacked by native robbers in Ugogo and slain, with sixty-three followers. Since then the Rev. Mullins has left England in order to reorganize the Tanganyika station and then penetrate from the south end of the lake to Lake Nyassa. At the same time some French Catholic missionaries, from Algiers, have left Zanzibar for the interior in order to establish stations on the banks of the Tanganyika and the Victoria Nyanza.

The Nile and upper lake regions have also been chosen as fields of action by

several missionary and exploring expeditions. The Rev. Wilson is still at Rubaga, King Mtesa's capital of Uganda on the Victoria Nyanza. In last August he traveled along the west and south lake shores to Kagahig--Stanley's old camp—where he met Mackay, who had come on from Zanzibar through Unyanyembe. The little missionary steamer, Daisy, is now afloat on the waters of the Victoria Lake. The other three members of the Church Missionary Expedition have by, last accounts, reached Bigaf on their way to Uganda by way of the Nile. This place is above Gondokoro, and near the cataracts. The extraordinary height of the river was the cause of their long detention, but they have probably reached Mtesa's early this year. Dr. Schnitzler, who is called by the Turks Emin Bey, has also arrived at Uganda, where he met Mr. Wilson, and Dr. Junker is now making extensive explorations in the region of the White Nile and its numerous tributaries. Gordon Pacha and Gessi are still busy putting down the slave traders in those countries. Dr. Schweinfurth continues his explorations of the Arabian Desert and has now turned to the Fayoum for botanical and geological work.

THE ITALIAN EXPEDITION.—The Italian Expedition to Southern Abyssinia has not yet succeeded in advancing far. Dr. Mattenci, after having been turned back once, has again arrived at Massowa, on the Red Sea. In March last Captain Martini and Signor Antonelli, a nephew of the late Cardinal, left Leghorn to go to Shoa with a great number of presents for King Menelek. They have arrived at Zeila, where they met the King's caravan, which is to take them and their goods to the capital. They will then push on to the south to join the Marquis Antinori, who is already reported at Kappa. The previous news of his death has been officially contradicted. Meanwhile, Cecchi and a companion have been taken prisoners by the Gallas, and the King of Shoa has sent out an army to rescue them.

THE WEST COAST.—The same German African Society which has equipped Rohlf has sent forth several others of its explorers on this side of the Continent. Dr. Buchner, who sailed from Hamburg, October 19th, for San Paul de Loanda, left the coast in December, and went up the Kwanza River to Malange, which he reached January 28th. He is now at Cassange, still further west, near the Kwango, and is waiting for the end of the rainy season in May, before going on to Mussumba, the new capital of the great Mwata Yanvo, for whom he is taking presents from the German Emperor. If possible, he will then follow the Upper Lualaba down to Nyangwe. Engineer Schuette, who is sent out by the same Society, arrived at Loanda December 10. While exploring the course of the Upper Kwanza he was robbed of all his goods by the Bangala, near the Rio Lui, on August 17th, but succeeded in crossing the Kwango, and has now gone northeast from Kimbemdu, in order to penetrate into the Adjellengo country. Major Mechow, a third member of this German expedition, will attempt to descend the Kwango River from Cassange till it joins the Congo, where Stanley heard it called the Ibari Nkutu.

FRENCH EXPLORERS.—The French explorers have also executed some important work on the west coast, taking their Senegal and Gaboon colonies as starting points. Lieutenant de Brazza has returned to Paris from his successful expedition to the sources of the Ogowai, but he intends to start again soon for Africa, in order to follow down the Alima or some other of the eastward streams discovered by him, and return by way of the Congo. Paul Soleillet has not succeeded in his attempt to reach Timbuctoo and then cross the Sahara to Algiers. He left the French settlement of St. Louis, on the Senegal, April 17th, and reached Segu, on the Upper Niger, on October 1st. He stayed there three months but was prevented by the Sultan from descending the river to Timbuctoo. He has recently returned to Paris but intends to make another attempt to reach his goal by way of the northerly oasis of Tishit. Count de Semelie left Bordeaux in April last, and in May went up the Niger and then ascended the Binnie, its right branch, as far as Okeri; he returned to Fernando Po February 13. Lieutenant Marche, who has already made an expedition up the Ogowai, left Paris recently, in order to continue the exploration of the still unknown Brinne sources and the country between the Shari and the Congo. The French Geographical Society has just appointed a committee for African explorations, which has decided to send out three expeditions. They will start simultaneously from Algiers, the Senegal and the Niger, and are to meet at Timbuctoo.

COMMODORE SHUFELDT.—The Lower Congo will also be further explored, while Commodore Shufeldt will go up the river in the United States Steamer Ticonderoga as far as the first falls. The Baptist Missionary Society will soon launch a small steamer above the Livingstone Cataracts, with which the Rev. Comber intends to ascend and explore the mighty stream which Stanley was the first to reveal to the world. Major De Serpa Pinto has just crossed Africa from west to east in 300 days. The foregoing summary of all exploring expeditions at present engaged in penetrating into the interior of Africa shows how much energy is now being employed to open up the "Dark Continent." We may therefore look forward to the early attainment of some very important successes in African exploration.

AUSTRALIA.—In Australia, Sergison's expedition in the northern territory and Forest's in the western are to be noted though one from Queensland westward does not seem to have made much headway. D'Albertis, in his two recent papers read in London, has given the chief results of his long and thoroughly scientific exploration of New Guinea. The gold discoveries in the island by Mr. Goldie have caused much stir in Australia, though the straggling bands of adventurers that have gone to collect it have not done either themselves or the natives much good. Mr. Goldie has added a little to our knowledge of the interior and the southwest coast. The narrative of the French explorer Raffray of his visit to the north of the island was given this year to the Paris Geographical Society; his

study was mainly of the people. We recently gave the results of Miclucho-Maclay's visit to the Pelew Islands. Dr. O. Fusch, of the Berlin museum, has recently started on a journey of exploration to Southeast Asia and Astralia; from so qualified an observer the best results may be expected.

SERPA PINTO'S WHITE AFRICANS.

Among the many interesting particulars of discovery brought from Africa by the gallant Portugese explorer, Major Serpa Pinto, none is more absorbing than his story of the white people encountered between the rivers Cubango and Cuando. Senhor Pinto found in these districts a tribe absolutely European in tint, yet nowise of the Albino type, for their hair was black and woolly. He describes them as uglier than the plainest negroes, and lower in civilization than any race met with. Two of the tribe he captured, and, having tamed them by kindness, induced them to take him to a village of these pale-faced Cassaqueres, where the explorer passed two days. They wander over the country, living upon the chase. Having receding foreheads, slanting eyes like the Chinese, prominent cheek bones and hanging lower lips, their general appearance fails to do much credit to the white man, whom they resemble In hunting they are marvelously skillful, and can bury one of their reed-arrows in the body of the elephant up to the middle of its shaft. The traveler saw a girl among them fairer than himself, and those who have the pleasure of Major Pinto's acquaintance will be aware that he is by no means a dark man for a Portuguese. Who, then, and whence are these people so strangely recalling the tribe spoken of by Mr. Stanley between the Equatorial Lakes? The African whites, the Anthropophagi and the Dwarfs have now all been found, and it only remains to discover the people with tails, the peculiar tribe that shade themselves from the heat with their enormous feet, and those remarkable beings who "eat their parents and curse the sun," to have completely verified the wildest stories of Herodotus.

A LETTER FROM NORDENSKJOLD.

We are enabled to lay before our readers the following extract from the famous arctic explorer's last letter to his family. The letter is dated: "On board the Vega, icebound on the north coast of Siberia, just east Koljuschin Bay, latitude 67 deg. 7 min. longitude 173 deg. 15 min. west of Greenwich, the 16th of October, 1878 —Since I last wrote from the mouth of the Lena River the Vega has pressed forward, though with no little difficulty, to the vicinity of Behring Strait—*i. e.*, to the part of the Polar Sea which is every year visited by whalers from the Pacific Ocean and trading vessels belonging to the American Alaska Company. These vessels have frequently left these waters as late as the middle of October. As a result from the northern and northwesterly winds blow-

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ing in these regions during the whole of September, it appears however, that this year a most unfavorable condition of the ice has prevailed in the Polar Sea, near Behring's Strait. The ice-free channel which in the proximity of the coast facilitated our progress as far as beyond the mouth of the Lena River, ended at the Basanow Islands, which we passed on the 3d of September. Since then we have gone through dense masses of floating ice so slowly that we did not reach the eastern coa·t of Koljuschin Bay until the 27th of September.

"The night of the 20th, the ocean was covered between the glacial fragments with new formed ice, so that we were forced to abandon further attempts to proceed, but temporarily lay to alongside some large floes of solid ice about half a mile from the beach. Three days later we were able to walk ashore on the new formed ice. Consequently everything is as satisfactory as possible, in the event of our being obliged to spend the winter here. The coast is inhabited by Tschutsches, with whom we are in communication on most friendly terms, although as these natives do not understand or speak Russian, we have some difficulty in making ourselves mutually intelligible. Lieutenant Nordgvist, however has made a good beginning in learning their language. They declare unanimously that the ice will again break up ; but in the event their prediction should fail I send this letter by a Tschutsch chief, who happened to visit the village near our place of anchorage. It is most uncertain whether we will succeed in making him understand the meaning of the papers we hand him, and it is doubtful whether they will ever reach their destination. All hands are well, the vessel in perfect condition and the supplies of coal and provisions abundant. The Tschutsch chief, who has appointed me to be the *Ispravnik* in Ochotsk, was pulled to the vessel, when he paid us his state visit, in a sleigh drawn by two of his dwarfed subjects."

THE SIBERIAN TSHUDI.

A letter from one of Prof. Nordenskjold's assistants, recently published in various Scandinavian papers, gives an interesting account of the Tshudi, a peculiar race inhabiting the northeastern part of Siberia. They look very much like the Greenlanders; are small but alert, have a brownish-yellow skin, with coal black eyes and hair, and a singular joyless, almost frozen expression of face. They live in tents, dress in skins, and feed on seal-flesh. Their women are tattooed in the face. In their intercourse with the crew of the *Vega*, they were a little shy, but curious like penguins, and willing to help. Their moral ideas were rather *naif* but firmly adhered to, as far as they went. Of their language a dictionary (Tshudi-Swedish) has been made, comprising about three hundred words, and it will, no doubt, prove of interest to the linguists, as the tongues of the Polar races have hitherto been as great a puzzle to philologists as those of the negroes of tropical Africa.

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NEWS FROM THE JEANNETTE.

The Arctic steamer Jeannette was at Port Illuluck, Ounalaska Island, on the second day of August. After taking on board a supply of fresh water and provisions she was to sail north on the fifth. Her route from Ounalaska harbor, which is on the north side of the island, 2,100 miles from San Francisco, will be as follows: She will pass through Unalga Pass from the Pacific Ocean into Behring's Sea. The prevailing winds are usually westerly, but after reaching about 50° north latitude, calms and fogs prevail. From Ounalaska, after having coaled ship, she will proceed to St. Paul's Island, two hundred and forty miles distant. At St. Paul's is a trading post of the Alaska Commercial Company, and there she will receive a supply of sealskin clothing for the crew, presented by the Alaska Company. From thence she will sail for St. Michael's, near the mouth of Yukon river, a distance of five hundred miles from St. Paul's, where dogs, sledges, snow shoes, fur clothing and a few natives will be taken on board. From St. Michael's she will proceed to St. Lawrence Bay, on the coast of Asia, a distance of two hundred and thirty miles, for the purpose of obtaining news of Prof. Nordenksjold's expedition, as well as to procure additional fur clothing and supplies. From St. Lawrence Bay the Jeannette will pass directly through Behring's Strait into the Arctic Ocean, shaping her course along the shore of Wrangel's or Killett's Land.

THE GEOGRAPHICAL SOCIETIES' ANNUAL.

Messrs. Paul Dreyfus and Armand Lucy propose to undertake the publication of a "General Year Book of Geographical Societies." The work is to contain each year the regulations of each society, a list of its members and an analytical *resume* of its work during the preceding session.

In the case of foreign societies, however, on account of space, they will publish full lists of members only in cases of special agreement, confining themselves otherwise to the names of the persons who compose the governing bodies. The general body of the work will be preceded by a brief account of such occurrences during the previous year as are of interest to geographers, together with biographical and obituary notices

The editors request that all communications on the subject of this work may be addressed to M. Armand Lucy, No 10, Cité Trévise, Paris.

The Royal Geographical Society of Great Britain encourages the study of geography in the public schools by the annual award of gold and silver medals to the four pupils who pass the best examination upon the especial subject selected by the society. At the last annual meeting it was stated that out of fifty-three large schools which were invited to send candidates at the last examination, sixteen had done so. The subject selected for next year's examination was "Western Africa," between the Sahara, the territory of Egypt, the Equatorial Lakes and the 6th parallel of south latitude, which just takes in the mouth of the Congo river.

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PHYSICS.

THE MAGNETIC SURVEY OF MISSOURI.

Last summer Professor Francis E. Nipher, of Washington University, St. Louis, and Mr. J. W. Shaub, his assistant and a student of the University, spent several days in this city taking magnetic observations. The high bluff on Seventh street, between Walnut and McGee, was selected as the most eligible location in the city to make the necessary observations. The determinations made are:

1. The declination, or "variation," of the magnetic needle.

For this purpose, the true meridian is determined by observations on the sun or the pole star.

For determining the magnetic meridian, observations are made on a magnetic needle, by means of a transit instrument. The needle is of unusual form, and consists of a hollow steel cylinder, suspended by a fiber of unspun silk. In one end of this hollow magnet is a scale with 160 divisions, each representing two minutes of arc. This scale is in the principal focus of a lens, which is fixed in the other end of the magnet. Through this lens the magnet scale is observed by the telescope of the transit, which magnifies sufficiently so that one-tenth of a scale division, or one-fifth of a minute, can be read.

The angle between the true meridian and the magnetic meridian is the variation sought. For Kansas City, this variation is 10° 7′ east. This angle is decreasing at the rate of about three minutes per year. In the Eastern States the needle points west of north, while near Cleveland, Ohio, there runs a line of no variation.

2. The "dip" of the needle is also obtained. This is done by means of an eight-inch needle, which is exactly balanced on agate supports, so that it can move in a vertical plane. When the plane of the needle—and the circle in which it plays—is in the magnetic meridian, the north pole of the needle is found to dip downward, in the northern hemisphere, while the south pole dips downward in the southern hemisphere. The dip increases to the north, and becomes 90° (that is, the needle stands vertically) at the magnetic pole. At Kansas City the dip is 69° 10′; at Iowa City it is 72° 2′, while at Vinita, Indian Territory, it is 66° 40′.

3. The *intensity* of magnetism is obtained by oscillating the same magnet at different places, the time of oscillation being determined to the one-thousandth of a second. The strength of this magnet remaining the same, the magnetic force of the earth (horizontal component) varies inversely as the square of the time of oscillation. The magnet, however, gradually loses its strength, and it is therefore necessary to make a correction for this. This is done by the so-called method

of deflections, but the manner of doing this is somewhat difficult of explanation to non-mathematical readers, and hence may be omitted. The magnet used by Prof. Nipher has been in use for over twenty years in the coast survey, and changes very little now.

It is also necessary to correct all the observations for the torsion of the delicate silk fiber on which the magnet hangs, and for the varying temperature. An increase of temperature causes the magnet to move more slowly, for two reasons: 1st, the magnet itself is weaker; 2d, by expansion, it becomes slightly longer. These corrections are, of course, small; but it is necessary that they be made.

Prof. Nipher spent the summer vacation last year in making a magnetic survey of the state of Missouri, and in some instances he took observations outside the State, and even went as far south as Vinita, Indian Territory. When the summer session of the University closed last June, he went to work again for the purpose of testing some of the observations made last year, and to take additional ones this year. The first observations he took this year were at Des Moines, Iowa, where he ascertained the exact variation of the magnetic needle. Then he came back to Missouri and went to work again. On arriving here he went to the same location that he occupied last year in this city, and, with the assistance of Mr. Shaub, took observations the greater portion of the day, which verified in a remarkable degree those taken last year.

Part of the instruments used in the survey are loaned by the Coast Survey, the others having been constructed in the work-shop of Washington University. The means necessary for carrying on the work have been in part given by public spirited citizens of St. Louis, the deficit being made up by Prof. Nipher.

But of what use is this magnetic survey? So far as a direct pecuniary advantage to the state is concerned, it is worth but little. It does not propose to change any boundary lines that have been established by the general government; neither is it intended to throw Kansas City west of the boundary line between Missouri and Kansas, nor to unsettle dividing lines between neighbors. Nothing of this sort is intended. Prof. Nipher is willing to undertake the work simply as a contribution to science. It is, however, important that the distribution of the earth's magnetism be accurately known, as this renders the use of the mariner's compass safer. These values have never been accurately determined for the interior of our continent, and hence the Missouri observations will fill a gap in our knowledge of this subject.

Prof. Nipher assures us that these determinations will probably bring out some new points in relation to local distribution of magnetism, the nature of which he declines as yet to make public.

William Leroy Broun describes a new lecture experiment, to show the action of terrestrial magnetism. A rectangular frame of light wood, carrying twenty coils of insulated wire, was suspended in a horizontal position from the pans of a balance, so that the long sides of the rectangle were at right angles to the

beam; and mercury connections were arranged at the middle of the short sides, so that a current could be sent through the wire. This apparatus being placed with the long sides of the rectangle perpendicular to the magnetic meridian, when the battery current passed from east to west on the northern side, and from west to east on the southern side, the north side would be attracted, and the south side repelled by the earth currents, both influences combining to deflect the beam of the balance. On reversing the current the deflection was in the opposite direction (*Nature*, vol. xvii., p. 281).

MINING INDUSTRY.

THE GEORGIA GOLD BELT.

BY ERNEST INGERSOLL.

The "gold belt," of which the most productive portion lies at this point, consists of a strip of land running somewhat irregularly nearly due northeast and southwest across the northern end of the state. It averages about ten miles in width, and has been traced 200 miles in length, parallel with the Blue Ridge. White, Lumpkin, and Habersham counties embrace the richest deposits, so far as now known, but the limits of mining are gradually widening. The presence of gold here has been known from the earliest times. Cherokee Indians were the occupants of the territory when white settlement first began, and they were accustomed to seek the gold for ornamental purposes, and to dispose of it in barter to less fortunate tribes. Evidences of their mining still remain, but are insignificant. The methods adopted by the first white settlers, and in vogue until recent years, were very rude, consisting merely of washing out the gravel of the beds of the streams by running it through sluice-boxes and splint baskets into a "gum rocker," which was nothing but a split and hollowed out log a dozen or so feet in length. * * * * * * * * *

It is said that the first piece of gold ever taken in the United States belonged to this deposit, and was picked up in 1799 by Conrad Reed, a boy who lived in Cabarrus county, North Carolina. It was as large as a smoothing-iron, but was sold to a silversmith for $3.50. Afterward much larger lumps were found; one weighed twenty-eight pounds, according to tradition. This excited so much attention that exploration was begun, and the gold traced southward until the borders of the Cherokee territory in northern Georgia were reached, and prospectors began to encroach upon the reservation. Protests from the Indians naturally followed, and Georgia sent a large police force to keep back the invaders, but it was of little avail. The rush to the mines was much like the stampede to the Pacific coast in 1849. * * * * * * *

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Finding that no protection of the Indians by police measures was feasible, the state, in 1830, adopted the Indians, territory and all, and constituted the region a county, called Cherokee, out of which several small counties have since been made. Then the mineral lands were divided up into forty-acre lots, and put up at a lottery by the state. One of these lots, on the Yahoola river—No. 1052—now a part of the Hand Company's property, had already become celebrated. It was within the reservation, but men used to creep across to it at night, and carry home a meal-bag full of dirt, out of which they would pan from twenty to forty dollars next day. The instant it was ascertained that an old farmer down in the central part of the state had drawn this prize, shrewd speculators set off post-haste to buy it from him. * * * * * * *

It soon came to be found here, as elsewhere, that gold was not to be picked up in twenty-eight pound lumps every day, nor did every bushel of soil pan out a double-eagle. At present the mines are largely owned by corporations, or by private capitalists who are not residents of the district. Only two of the companies, however, are represented in the New York Mining Board, if I am rightly informed. It was found that as the gold occurred neither in extensive placers, like those of California, nor in indestructible quartz lodes, the methods of mining in vogue elsewhere would not answer here if the best results were to be obtained. But the utilization of water, and the practical methods by which the enormous power of this natural agent has been put under the miner's control, are the work of Colonel Hand, to whom, more than to any one else, no doubt, belongs the credit of the splendid development of this industry during late years, and the glowing prospects it now holds out.—*Harper's Magazine for September.*

WEALTH OF THE SAN JUAN REGION OF COLORADO.

LIEUT. C. A. H. M'CAULEY, U. S. A.

We cull from the official report of an extensive and thorough reconnoissance of the San Juan Region, in the fall of 1877, by Lieutenant McCauley to the Chief of Engineers, the following items, which will doubtless be of interest and value to many persons already owning property there, and to others who incline to invest but lack confidence. Of course many important changes and advances have taken place in some localities since this report was made, but the main facts as to minerals, geological formation, topography, &c., remain the same and can be relied upon as conclusive.—*Ed.*

"The San Juan is locally subdivided into mining districts. In speaking, therefore, of mineral wealth as it appeared to an ordinary observer, it will be best to consider each district visited in its practical development.

The precious metal is mined in the form of both silver and gold, the former predominating. Of the latter the value of the placers is inconsiderable, and upon lodes alone should any dependence be placed.

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In arriving at the value of a mineral deposit, from a casual examination of specimens of its ore, the most learned geologist, the most experienced assayer may be at fault. Nothing short of a complete assay will give its definite and precise value and worth.

The extension of this rule is equally true. The value of a mine can never be wholly determined by any specimen. The market price of the ore in general must alone be taken. In brief, the "mill-runs," or prices paid at the smelting-mill or other reduction-works, is the sole standard upon which dependence is to be placed.

In giving the ton-value of the ore it is frequently placed in ounces. This is, correctly speaking, the proper mode, though not always the popular one. At the time of the examination of the mines the value of the standard silver ounce was $1.20. An increment of one-fifth to the ounce per ton will therefore represent the money value when otherwise denominated.

The Summit District is some 27 miles southwest of Del Norte, reached from the latter point by a fine toll-road, and lies mainly upon the slopes of South Mountain, a divide between the waters of the North and South Forks of the Alamosa.

This is a most remarkable gold district. It may be said to consist chiefly of a single mine; for, while the mountain is covered with stakes, there being in all 2,300 locations upon it, one of them is of immense value, some half a dozen are worth having, and the whole of the rest are not worth $5 at present.

No well-defined veins or lodes have as yet been found, as, in true fissure formation, the mineral-bearing rock, consisting of "rotten" or decomposed quartz carrying free gold, the metal being free from impurities and more easily milled than any other gold ore in Colorado.

The principal mine of the district is the Little Annie, other prominent lodes being the Golden Queen, Major, Yellow Jacket, Ida, Golden Star, Summit, and Odin.

The Little Annie having proven very valuable, it was surrounded upon every side with locations, but up to the present time none of these have given positive indications of deposits of the same character and value.

Assays of Little Annie ore have varied from a small amount to many thousands of dollars. The average mill-runs have been $102 per ton, the best ore being $150, tailings $48, the cost of mining and milling being $12, leaving a large profit to the stock-holders or foot-holders of the mine. The lode was 85 feet below the surface, the pay streak, so called, being from 20 to 25 feet wide. This is remarkable as being the highest mine in the world, lying at the edge of timber-line and not far below 12,000 feet, the reduction-works in the gulch at the base of the hill being about 11,200 feet above the sea. This was one of the best paying and most economically managed property found in the San Juan, and can scarcely be surpassed in the whole of Colorado. At the time of the first visit (June 30, 1877) there had been taken to date from the opening of the mill, as we were informed by Mr. C. E. Robbins, the treasurer and chemist of the company,

$105,000, of which $47,000 had been paid out in dividends, the balance being expended in the plant, including a 10-stamp mill, and items of current expenses. A tramway of over 2,000 feet in length conveys the ore from the dump-pile at the mine to the works below.

The Animas District is situated in the San Juan county and along the river whose name it bears. Half a mile above the mouth of Cunningham Gulch, opening into the Animas river, is the dividing line, we were informed, between this and Eureka district, which lies to its north. It includes mainly, therefore, the mines in the gulches and creeks, reaching the Animas and Baker's Park and those upon the overlooking mountains, chiefly along Cement and Mineral creeks, Arastra, Boulder and Cunningham Gulches, and upon Sultan, Anvil, Green, Hazleton, Galena and King Solomon Mountains. It is the oldest mining district of the San Juan, containing the Little Giant, whose early discovery resulted in the great immigration to the country. It includes some of the most valuable mines in the valley of the river, and within its limits a larger number of lodes of a high quality of ore have been located, and in part are being worked, than in any other district of the San Juan.

The ores of this section are argentiferous, with the exception of those of the Little Giant and a few other exceptional ones, which have been found to contain gold; in general, therefore, they may be said to be of argentiferous galena, with and without gray copper, occasionally chloride of silver, and in several mines the black sulphurets being found.

The number of lodes that contain first-class ore is very large, and as there are over 2,000 lodes registered in the county offices at Silverton, and the prospects of all are, in general, very good, the work involved in an examination of this district may be imagined, the mountains being everywhere covered with apparently an inexhaustible quantity of lodes.

The most prominent mines are the Little Giant (gold), (now called the Golden Giant); Highland Mary, Pride of the West, Philadelphia, Susquehanna, Pelican, Aspen, Green Mountain, Legal Tender, Victor, Little Fanny, North Star, Letter G, Molly Darling, Pelican, Bull of the Woods, Comstock, Silver Cord, and King Hiram Abiff (gold).

Viewed financially, this section labors under more difficulties than any other of the San Juan. With large bodies of valuable mineral within it, the lack of capital and reduction-works keeps them undeveloped. At no place is there so fine an opening for a banking firm. There exists none in the town, and with the activity of trade the scarcity of currency is severely felt; local checks of various kinds, the shinplasters of war times, and drafts on distant banks being had recourse to.

In the entire San Juan the discoverer of a vein or lode is allowed a surface area of 1 500 feet along the vein, 150 upon each side of the vein and perpendicular thereto. The planting of a stake containing the location notice and the designation of its boundaries holds the "mine" for the period of sixty days, by

the end of which time a 10-foot shaft must be sunk, or a vertical exposure of 10 feet of the vein be made, to prevent its being "jumped," or taken by the first comer. Within a month or ninety days from the date of the discovery stake, the location certificate must be filed in the office of the county recorder. The amount of work necessary upon a lode to file this certificate is generally known as the first assessment, a certain amount in accordance with the requirements of national statutes being annually required to prevent forfeiture. It therefore follows that while a large number of locations may be indicative of promising mineral deposits, that fact alone does not decide the wealth of the district. Without thorough development the richest vein is as valueless as the most worthless prospect holes.

From an outline sketch, herewith accompanying, (Fig. 4 of Cunningham Gulch, Plate 6,) an idea may be formed of the deeply eroded character of Cunningham Gulch, and the location of the mining properties at its upper end.

Within the Animas section, as may be inferred, are situated a larger number of first class and high-grade silver mines than are found in any other district of the San Juan The lack of reduction facilities and good roads has been its drawback.

The supplies of material reaching Silverton are mainly brought by trains of burros, which are valued here at $25 to $30 each. Freight by burro-trains from Silverton to Antelope Springs is two cents per pound; for return freight three cents is charged. These trains are in charge of a driver, receiving from $60 to $75 per month; the pack transportation being 150 pounds for a burro, and from 200 to 250 for a mule.

The Eureka District, adjoining the Animas upon the north, is small in extent, but rich in lodes, and lies along the Animas river, from the dividing line near Howardsville to the divide between the Animas and Uncomphagre rivers. The most valuable mining properties are found in Eureka, Maggie, and Minnie Gulches.

The towns of the district are Eureka, at the mouth of that gulch and about nine miles from Silverton, and Animas Forks, located at the junction of the two upper branches of the river, four miles farther up; both of these, however, should be properly known as mining camps.

The principal lodes are the Tidal Wave, McKinnie, Crispin, Sunnyside, Yellow Jacket, Golden Fleece, Venus, Emma Dean, American, North Pole, Jackson, Grand Central, Big Giant, Little Abbie, Belcher, Chieftain, Boomerang, Silver Wing, Lily, Golden Eagle and Great Eastern.

The ores are in general argentiferous galena of high grade, gray copper accompanying; in Burns' Gulch specimens of the Lily and Golden Eagle lodes contained brittle silver in considerable quantities, while in Eureka arsenical ores are found. On Jones' Mountain, not far from this gulch, the Silver Wing, one of the finest mines of the district, contains seven lodes so situated that they will be readily worked by a single tunnel. The owners propose erecting here, during the season of 1878, smelting-works for their own use.

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The Park District so named from its containing Burrows Park, a mountain valley between 10,000 and 11,000 feet in height, adjoins the Eureka on the east. Through this district a road from Animas Forks, via Cinnamon Gulch, passes down the Lake Fork of the Gunnison to Lake City, about 29 miles distant. This road, however, is in such wretched order that all teams for Lake go from Animas Forks, via the Hensen Creek toll-road, which is in fine order, besides being six miles shorter.

The Park District lies mainly in Hillsdale county, and within it are situated some fine properties which are being rapidly developed.

The principal mining points are Sherman, on the Lake Fork, at the mouth of Cottonwood creek; Argentine, about six miles farther up the stream; Tellurium, at the head of Burrows Park, and the American Basin, a huge depression, about two and one-half miles long and one wide, immediately to the west of Handie's Peak. Several gulches entering the park, also contain some valuable lodes, the most important of which is the Cleveland, coming from the northwest nearly, and below Tellurium.

Among the most promising and best developed lodes are the Hidden Treasure, Major, Vulcan, Mountain Curve, Garden City, Cuba, Little Edith, Lily, Inez, Cashier, Silver Queen and Del Norte.

The nature of the ores is wholly silver, no gold having as yet been found; they are generally a fine grade galena, with and without gray copper; a few of them carry diocrastie or antimonial silver, and one or two, indications of pyragyrite or ruby silver.

Their value is that of first-class ores in general, some few running to quite a low grade, but in large quantities. The Hidden Treasure, of the American Basin, gave an assay while we were at Lake of 3,287 ounces; some ore of the Major has sold for a dollar a pound.

The Uncomphagre District lies on the north of the Animas district, Cement creek being to the southeast, and the north fork of Mineral creek to the southwest of Read Peak or Mountain, while Red creek, of the Uncomphagre, runs down its northern slopes; it lies also northwest of Eureka district, Mineral City and Poughkeepsie Gulch, being in that direction from Animas Forks.

It lies, moreover, upon the Pacific slopes of the mountains, its mines being in the gulches of Poughkeepsie, Red, Bear and Cañon creeks, which dash down in most horrible and frightful canons, eroded from the massive mountains circling their heads, their bottoms choked with *debris*, and very often inaccessible. Words are inadequate to describe the appearance of these canons from above. Each looks like a perfect wreck of matter, or an exploded world piled below in strange confusion; the fiercely red peaks about lending a brilliant contrast to the long stretches of timber and the valley far below and beyond. The wealth of mineral deposited here by nature was apparently proportioned to its inaccessibility. Mines are most numerous in the Animas; capital has aided them at Lake most largely, but in the Uncomphagre Mountains nature made them richest.

Mineral City is its town, nearest Eureka district, being on a fine toll-road, three miles over the range from Eureka, and about twenty miles from Lake City, by the Hensen creek road. It is an important mining camp, is at the edge of timber line some 11,500 feet above the sea and is claimed to be higher up in the heavens than any other town in the United States, if not the loftiest mining camp of any size in the world.

Way down the Gulch, on the Uncomphagre river less than six miles by air-line, only seven and one-half or eight by trail, but one hundred and twenty by the wagon-road via Lake City, lies Ouray, the largest town of the district and rival, perhaps, of Lake City and Silverton in the distant future.

A mineral belt apparently runs to the southwest from about Ouray, including the gulches to the south, and continuing on to Red Mountain, at the head of Cement creek and the north fork of Mineral creek. Mines that lie within its course partake, more or less, of its peculiar characteristics, which differ from the Animas and other ores in possessing less galena and more of the sulphurets than other sections. Being of a high grade and easily treated, they are great favorites at works for the general reduction of ore.

In the northern part of the district, close to Ouray, on the west edge of town, and at the mouth of Canon creek, is the Fisherman lode, wonderfully rich, containing native and brittle silver, assays being as high as $30,000. The Trout is an extension thereof, containing gray copper, while the Johnny Bull, close by, carries the same ore as the Fisherman, and is presumed to be one of its spurs. The Ophir, Watson, Three Brothers, Cedar and Clipper are also near by; the Sivyer and Union, on Bear creek, and many others, including the Mount Cline, Alaska, Saxon, Tyrol, Poughkeepsie, Silver Coin, Gipsy Queen, Little Minnie, Out Pat and Lincoln Boy.

THE SILVER MINES OF ARKANSAS.

A correspondent of the St. Louis *Globe Democrat*, writing from Little Rock, describes the mining region of Montgomery County and its minerals as follows:

The district embraces townships 1 and 2 south, ranges 23, 24, 25 west, which includes a district of about 216 square miles.

The main water courses are the Wachita proper, and its south and north forks, besides a large number of small streams and rivulets, all more or less suitable for water power. The same tract of land is well timbered with yellow pine, white and black oak, ash, hickory, black walnut, gum, etc., well adapted for building and mining purposes.

The district forms a basin of small rolling hills, which are continuous throughout its entire length, and is surrounded by the Ozark Mountains on the north, the Mazerne Mountains on the south, the eastern spur of the Cassotal and Little Missouri Mountains on the west, and the Crystal Mountains on the east. These

mountains are of secondary and primary formation, containing hornblende, granite, slate and porphyry.

South of the Mazerne range is a younger formation of novaculate and limestone. The summits of the Crystal Mountains show ledges of metamorphic sandstone, underlaid by slate and sub-carboniferous limestone, which leads to the conclusion that this entire mineral belt is underlaid by sub-carboniferous limestone and porphyry.

The basin itself shows calcous shale and slate—the latter being generally exposed in the gulches and river banks—and is traversed by a belt of quartz veins which runs in an eastwardly and westwardly direction, and can be followed westwardly its entire length through the Cassotal range to the Indian Territory, thence through the Wichita Mountains, in the northwest part of Texas, striking the Rocky Mountains in New Mexico, the belt showing the same formation throughout its entire length, which has been conclusively proven by many of our most eminent geologists and mining engineers who have spent years of time and labor in determining this important fact, and who offer as an evidence of the correctness of this view the fact that the same minerals exist in the same character of quartz and spar throughout both entire districts.

The veins opened up to the present time have given evidence of walls and selonge, and are the quartz veins freely impregnated by gouche, which dip north, and have more or less strong overlap south, and have a general strike from 8° to 25° north of east.

The eminent geologists, Profs. Church and Phillips. during their stay in Silver City, made upward of thirty assays, with the most gratifying results, the quartz. with two exceptions, ranging from 200 to 600 ounces of silver to the ton, and this from specimens picked up indiscriminately from the surface, and in which not the slightest indication of ore was perceptible.

These gentlemen were astonished to find such results from quartz that made no showing whatever and was in no case taken from a greater depth than twenty feet, which was hardly sufficient to enable them to determine with any degree of accuracy the extent or value of the ores of greater depth, but gave it as their opinion that their greatest richness would be at a depth of one hundred and fifty feet.

Prof. Phillips, who was in Mexico in the months of September, October and November, examined a large number of old silver mines in Chihuahua and Durango, and who has been four months in Arkansas examining its silver resources, states that the two fields in their general geology are almost identical in character, and feels convinced that these high grade ores from the quartz veins of Montgomery County will run to wire and other forms of native silver at a depth of 100 to 200 feet, as similar surface ores were found in the same character of quartz encased in slates as were mined by the old Spaniards at Parral, Santa Barbara and Inde, in the State of Durango, and all of which veins carried more or less native silver at a depth not exceeding 100 feet from the surface.

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BOOK NOTICES.

THE HUMAN SPECIES. By A. De Quatrefages. New York; D. Appleton & Co., 12 mo, pp 498: For sale by M. H. Dickinson, $2.00.

This is volume XXVII of the International Scientific Series, and in our opinion one of the very best of the whole. Nothing equal to it on the same subject has come under our observation, whether considered in a literary, scientific or philosophical sense. The style of the author is clear, his knowledge of the subject profound, his treatment of other writers fair and his argument logical and convincing. Passing over the entire range of anthropology, beginning with the Various Kingdoms of Nature, he gives concisely the several anthropological doctrines and those tending to show the Unity of the Human Species; then the different hypotheses in regard to the Origin of the Human Species, with his own conclusions; then the Antiquity of the Human Species; Original Location of Man; Peopling of the Globe; Formation of the Human Races; Fossil Human Races; Present Human Races, and closes with the Intellectual, Moral and Religious character of the Human Species.

In the treatment of all these branches of the subject, the same close familiarity with all the investigations, theories and hypotheses that have been made, is manifest, and the same spirit of candor, in examining and disposing of them, prevails that characterizes the opening chapter.

As a compendium of all anthropological knowledge, and a complete philosophical dissertation thereon, this book will meet the wants of multitudes of readers.

THE ANNUAL RECORD OF SCIENCE AND INDUSTRY, 1878. Edited by Spencer F. Baird. 8 vo, pp 715. Harper & Brothers, New York. For sale by H. H. Shepard, $2.00.

At no period of scientific progress has the absolute need of a reliable and judiciously arranged abstract been so apparent as at present, and the scientific men and students of the United States are to be congratulated that this work has fallen into so capable and willing hands as Prof. Baird and his associates. It is well known that in no other country has this kind of work been so faithfully done. Volumes of a similar character have been frequently published in other lands, but they have not reached the fullness and completeness of this, for the reason that competent men have not been willing to give their time to the work. In America, however, the most eminent men in their different departments and branches of science have freely devoted themselves to the task of compiling from an almost endless list of sources, all the important facts showing the world's progress in their respective specialties, and, as must necessarily have been the

case, their work commands the respect and praise of intelligent readers of all nations.

As heretofore, Prof. E. S. Holden edits the astronomical department; Profs. Abbe and Rockwood that of physics of the globe; Prof. Geo. F. Barker those of terrestrial physics and chemistry; Prof. E. S. Dana that of mineralogy; Prof. T. Sterry Hunt that of geology; Lieut. Commander F. M. Green those of geography and hydrography; Prof. Hamilton L. Smith that of microscopy; Prof. Otis T. Mason that of anthropology; Prof. A. S. Packard Jr. that of Zoology; Prof. Theodore Gill that of vertebrate zoology; Prof. W. G. Farlon that of Botany; Prof. W. O. Atwater that of agriculture and rural economy; Prof. W. H. Wahl that of engineering, technology and industrial statistics; Prof. Theo. Gill those of bibliography and necrology. The index is one of the most indispensable features of the work, being copious and accurate. No scientific library is complete without this book, and no editor, lecturer or student can spare it from his table.

FANTASMA, AND OTHER POEMS. Kansas City, Mo.: Ramsey, Millett & Hudson, 1879; 12mo, pp. 318.

This little work was laid upon our table by a well known and accomplished writer of this city, "with the compliments of the author," but whether he intended thereby to mislead us or not, a few moments' perusal of the leading poem satisfied us that a more delicate, though perhaps not a more skillful and tuneful hand, had struck the lyre in its harmonious lines.

In "Fantasma" the beauty of the story, and the purity of the thread of thought upon which its frequent pearls of poesy are strung, fully occupy the reader's mind and totally overshadow any possible shortcomings in versification for all readers except "professionals," who, from the very nature of their employment, lie in wait for defective iambics and trochees like cats for erring mice. The sentiments of the writer are exalted, which is the first requirement of true poetry, while the unfolding of spiritual truths, of which this work is a striking example in many portions, is justly regarded as the highest office of the poet. In these respects "Fantasma" may be regarded as a well rounded and admirably written poem. In other features of true poetry, such as imagination and rhythm, it is, as a whole, less successful, for, though there are many lofty flights, and most lines are perfect in their quantities, these characteristics are not uniformly sustained throughout. These are the views of a "professional," and will probably be regarded by most readers of this really meritorious poem as hypercritical; but we believe that they are just, and that they will be so regarded by the author by the time the work appears in a second edition.

The second poem, called "The Light Bringer," is more perfect in its versification than the first, but hardly equal to it in other particulars; and, in fact, this may be said of most of the subsequent and shorter pieces, though some of the latter contain gems of rare merit. Notably among them are "The Jewel Seeker,"

"Indian Summer," and "The Lily Queen," each of which discloses the genuine poetic taste and talent of the writer in frequent expressions of tender and exalted feeling and beautiful, life-like similes.

This is the fourth handsome book of poems published by Ramsey, Millett & Hudson within a year, which is an evidence of rapid æsthetic progress in the West, as well as that in business, science and agriculture, of which we boast so much.

THE DAWN OF HISTORY. Edited by C. F. Keary, M. A. Charles Scribner's Sons, New York; 12mo, pp. 240. For sale by M. H. Dickinson; $1.25.

This is intended as an introduction to pre-historic study, and seems to be the joint work of C. F., H. M., A., and H. Keary, the first named being the editor and connected with the British Museum. The numerous authorities consulted and the extent of ground covered in the preparation of the work show that it has been a labor of love and that no pains have been spared to give completeness to the world's knowledge of man so far as it could be done in so small a work. The main objects of the authors seem to have been to condense the general results of pre-historic inquiry to this date, and to indicate the methods of such inquiry when systematically and scientifically pursued. In these points they have been singularly successful, having put a vast amount of attractive and valuable information into the work.

To any one desiring an intelligent and readable abstract of the whole subject, with a complete list of authorities from every land, we know of no work so likely to answer the purpose.

SOME NEWSPAPER TENDENCIES. By Whitelaw Reid. New York, Henry Holt & Co.; 12mo, paper, pp. 76; 50c.

This is an address delivered before the editorial associations of New York and Ohio by the distinguished editor of the New York *Tribune*, in which he discusses the modern newspaper and its excellences and shortcomings. Having become satisfied that the price of the newspaper cannot be reduced because the people will not be satisfied with a less costly one, he proceeds to give his idea of what a newspaper should be; including better reporters, "brief summaries of the news for those who are hurried, supplemented by the most voluminous details for those who have special interest and ample leisure;" "better newspapers, the story better told, better brains employed in the telling;" and "greater judgment in selecting and genius in telling it." He concludes that the ability of the press is not declining, but insists that the papers of the country are better edited than they ever were before, their average courtesy greater, their average morality purer, and their adaptability to the wants of the whole closer.

It is an excellent essay; one which, if read generally by editors and newspaper readers, will have a good effect on both classes.

THE AMERICAN PLANT BOOK. By Harlan H. Ballard and S. Proctor Thayer. Size, 8¾ by 11¼; 64 leaves. Daniel Slote & Co., New York, 1879. For sale by M. H. Dickinson; $1.75.

The above named book—which is in reality scarcely a book at all, but simply a convenient sized herbarium in book form—is destined to receive a wide patronage among all people who love flowers and plants, whether botanists or amateurs, on account of its perfect adaptiveness, suitable shape and handsome appearance. It has been received with enthusiasm by grave professors, ardent collectors, and beauty-loving children, all of whom find it just what they want, in its different editions, of which there are four, ranging from one to five dollars in price, and from 56 leaves of about six inches square to 80 leaves of nearly twelve inches square. The specimens are to be attached by means of gummed strips (of which there is a full supply) to thick leaves of soft, porous paper, while between each two are printed blank forms for names, analyses, descriptions, etc. It really "supplies a long felt want."

FOOT-PRINTS OF VANISHED RACES IN THE MISSISSIPPI VALLEY. By A. J. Conant, A. M. 122 pp., large octavo. C. R. Barns, St. Louis, 1879.

Mr. Conant, who is only less well known as an archæologist than as an accomplished artist of St. Louis, contributed the chapters comprising this volume to a compendious volume known as "The Commonwealth of Missouri," published last year; but the general interest in archæology and the graceful style of the author created a demand for a reprint in a separate book, which has received the above title.

As we noticed the last named work in our August, 1878, issue, and copied freely from Professor Conant's article in our October issue of the same year, it is unnecessary again to express our high appreciation of it as a most valuable and interesting account of Western archæology, and especially of that of Missouri. Mr. Barns has brought it out in elegant style, and it will doubtless prove a complete success as a business venture.

OTHER PUBLICATIONS RECEIVED.—Proceedings of the American Association for the Advancement of Science, 1878; Chautauqua Assembly Herald, Chautauqua, N. Y.; Mind and Matter, Philadelphia, Pa.; Thirty-seventh Report of the University of Missouri; Organon of Science. by John Harrison Stinson, Eureka, Cal.; Report of the San Juan Reconnoissance, 1878, by Lieut. McCauley; Abstract of Colenso on the Pentateuch; Eighth Annual Report of the Kansas City Public Schools, 1878–9; the Tornado of April 14, 1879, by J. L. R. Wadsworth and Francis E. Nipher; Quarterly Report of the Kansas State Board of Agriculture, for the quarter ending June 30, 1879, by Alfred Gray, Secretary; the Necessity to Commerce of Cheap Water Communication between the West and the East; Catalogue of Elizabeth Aull Female Seminary, Lexington, Mo., 1878–9; Journal f Science, Toledo, Ohio.

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SCIENTIFIC MISCELLANY.

THE NEW YORK AND BROOKLYN BRIDGE.

The bridge now in process of construction connecting the cities of New York and Brooklyn, will have the longest single span of any bridge in the world. The main span will be 1,595 feet 6 inches, and the land spans 930 feet each.

The bridge was designed in 1867 by John A. Rœbling, but he died in 1869, before any work on it had begun, and it has been built entirely under the guidance of Washington A. Rœbling, the present chief engineer.

The bridge extends from the junction of Sands and Fulton streets, in Brooklyn, to Chatham street, near the City Hall, in New York—a total length of 5,986 feet, the Brooklyn approach being 971 feet, the suspended part 5,445½ feet, and the New York approach, 1,502½ feet.

The approaches will consist of a series of brick and granite arches, which, when finished, will be ornaments to the two cities. It has taken nine years to complete the towers and anchorages, construct the cables, and get everything ready for the suspension of the floor.

Preparing the foundations for the tower was one of the most difficult parts of the work. Huge timber caissons, each 179 feet long, 102 feet wide, and 25 feet high, containing over 1,600,000 feet of timber, were sunk below the bed of the river until they rested on rock, or an equally firm stratum. On the Brooklyn side this was reached at a depth of 45 feet below high water; but it was necessary to go 78 feet below high water on the New York side. The pneumatic methods of sinking caissons is not new, but the operations here surpassed, by their immensity, everything of the kind that had been done before. The towers are 278 feet high. The anchorages are 129x119 feet at the base, 117x104 at the top, and 89 feet high.

The total amount of granite and limestone in the towers and anchorages is 142,000 cubic yards, and it required the continuous work for four years of over twenty quarries in Maine, Massachusetts, Rhode Island and New York to furnish the necessary supply. In the summer of 1876 the masonry was completed.

On the 29th of May, 1877, the first wire for the cable was stretched across the river. There are four cables, each consisting of nineteen strands, each strand containing two hundred and eighty galvanized cast steel wires, No. 8 gauge. These cables are 15¾ inches in diameter. For wrapping the cables, galvanized annealed iron wire was used. March 1, 1879, the four cables were completed—just twenty-one months after they were commenced.

The platform of the bridge, which is five feet wider than Broadway, is sustained by the iron cross-beams, and stiffened by six longitudinal trusses. It is divided into five parts, two outer parts intended for horse-cars and general vehi-

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cle traffic, two intermediate divisions intended to accommodate the rapid transit passenger cars, and a central promenade, a little above the level of the main floor, and intended for pedestrians. The stiffening trusses will be iron, six in number, the two outer ones 9½ feet high, the other four sixteen feet in height. The total weight of the bridge will be 13,300 tons. It is proposed to move the cars on this bridge by means of wire ropes and stationary engines. This method is considered as preferable to that of locomotives, on account of the steep grade of the bridge.

It is estimated that the bridge, when completed, will have cost $13,500,000, of which $9,500,000 will be spent on the bridge itself, and $4,000,000 in acquiring the necessary real estate It is hoped that in 1881 the bridge will be opened to the public.

At a meeting of the trustees of the bridge, July 7th, the contract for supplying the steel and iron for the suspended superstructure was awarded to the Edgemoor Iron Company. The contract calls for 10,728,000 pounds of steel and 34,000 pounds of iron. The bid of the Edgemoor Iron Company was 4.35 cents per pound, amounting to $468,147. Chief Engineer Roebling said that when the change from iron to steel was first contemplated he supposed that the difference in price would be at least $100,000, but in fact the lowest bid for steel exceeded by only $4,000 the accepted bid for last year. The difference between the lowest bid and lowest bid for crucible steel was $365,000. Both towers of the bridge have been completed, the last work on the Brooklyn tower having been finished July 5th. Mr. Kingsley expressed the belief that through this contract it would be possible to complete the bridge by January 1, 1881. The financial condition of the bridge on June 30th was as follows: Total receipts, $10,623,492.94; total expenditures, $10,523,574 86; outstanding liabilities, $112,807.62.

UTILIZATION OF PHOSPHORUS.

Mr. Sidney G. Thomas, one of the inventors of the famous dephosphorizing process, not content with having rendered phosphorus—that dreaded impurity of iron and steel—harmless, has gone one step farther and proposes the utilization of the phosphorus which in his process is, as it were, concentrated in the slag. He roasts the cinder obtained in blowing pig with simultaneous additions of lime and oxide of iron, in a reverberatory furnace, in order to convert the protoxides of iron and manganese into insoluble peroxides. After calcination the slag is ground fine, and is treated with cold hydrochloric or sulphuric acid, diluted, or with a cold solution of sulphurous acid, which dissolves the phosphoric acid. With the latter solvent the phosphate will be almost at once precipitated on heating, while the sulphurous acid which is driven off may be recovered by condensation. The solution in hydrochloric or sulphuric acid may be completely evaporated, forming a concentrated product which, when the former acid has been

used, contains chloride of lime. These or any other methods practiced for the manufacture of phosphates may be made use of. As few have an idea of the enormous quantities of phosphorus which are annually wasted in the manufacture of iron, it may be interesting to cite the fact that the phosphorus contained in the iron produced in the Cleveland district of England alone amounts to 30,000 tons. Although the recovery of phosphorus is not a novel idea, it is possible that the concentration of phosphoric acid in the slag (7 to 15 per cent.) may render it practically attainable.—*Boston Journal of Commerce.*

LATE VIEWS OF THE AGE OF THE WORLD.

Geologists, astronomers and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometer which will approximately measure geological time, and thus give us some clue to the antiquity of our globe. It is therefore worth noting that Mr. Mellard Reade, of Liverpool, has lately contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index to geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later found strata are more calcareous than the earlier, and that there has been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean-bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to the author's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one-tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of gigantic or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made up of granites and basalts is found, by a comparison of analysis, to be on an average about 3.73 parts in 100,000 parts of water. It is further assumed that the excessed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data, Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600,000,000 of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian and Silurian strata must have occupied about 200,000,000 of years; the old red sandstone, the carboniferous, and the poikilitic systems, another 200,000,000; and all the other strata, the remaining 200,000,000. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.—*London (Eng.) Academy.*

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THE FOURTH OF JULY UNDER THE MIDNIGHT SUN.

A party of Americans celebrated the 102d anniversary of our national independence at North Cape, Norway, latitude 71° 15′, longitude 25° 50′. They arrived there at 11 o'clock on the night of July 3d, and at one minute after midnight guns were fired and the shrill sounds of the engine's whistle were made to respond to the number of stars on our flag, and loud cheers given to usher in our great national holiday. The party then ascended the almost perpendicular cliff (900 feet high) and raised the American flag, the flag being made for the occasion by the ladies of the party out of materials purchased at one of the Norwegian towns. When the flag was raised cheers and guns again resounded over the waters. It was certainly a most extraordinary place for such a celebration—probably the first time that a party of Americans ever celebrated the 4th of July at such an hour and at such a latitude and longitude. The midnight sun shone upon them all the time with dazzling brightness. Far to the north they gazed out on the Atlantic ocean dashing against the great cliff on which they stood. Behind them were the snow-clad mountains, along which they had been coasting, and not a living creature was near them but the sea birds that arose screaming from the water as the silence of their home was broken. The North Cape is beyond seventy-one degrees of north latitude, and about one hundred miles north of Hammerfest, the most northerly town in the world. It is five degrees further north than the most northern part of Iceland.

They had a fine dinner on board, at which the noted Dr. J. Lawrence Smith presided. They drank toasts to "The day we celebrate," to "The President of the United States," to "The King and Queen of Norway," and to "Queen Victoria." This last toast was proposed in respect to several English ladies and gentlemen who most heartily participated in the celebration. Other toasts were drank, with the usual accompaniments of the occasion.

The following Americans participated in the celebration: Miss Augusta Caldwell, Dr. and Mrs. J. Lawrence Smith and James G. Caldwell, of Lexington, Kentucky; Dr. and Mrs. G. A. Lyons and Dr. Marcus P. Stephenson, of New Pork; Wm. C. Todd, of Massachusetts, and Dr. George Guier, of Delaware.

AN AUTOMATIC SAND BRAKE.

Mr. W. Wiseman, of the Indian Government Railway Department, is the inventor of a peculiar and original automatic sand brake for railways, which the *Engineer* describes and illustrates in a recent issue. On the axle of every wheel of the train is placed a cylinder, in which a circular plate, keyed to the axle and bearing a number of small blades, revolves whenever the train is in motion. The blade compartment surrounds a cylindrical compartment, which, being filled with sand, is called the sand box. The upper and the lower portions of this box are in communication with the blade box by a number of parts, of which the lower

can be opened and closed by means both of an electrical mechanism and automatically, while the upper ones, which are smaller, are always open. A plate, keyed to the axle, opens the lower sand ports with every revolution, but the sand thus escaping is so small in quantity that it is immediately swept back by the blades into the sand box through the upper ports. As soon, however, as the electrical circuit, which also controls this sand valve by means of an electro-magnet, is broken, the sand flows from the box very quickly, and, packing the blade box, stops the train. The same will occur when the train moves too rapidly or when one or more cars are left behind. It is, therefore, automatic, and its effect increases with the velocity of the train. Experiments made with a seven-horse-power engine were quite successful and promising.

Messrs. Torrey and Eaton, of the United States Assay Office in New York, made an assay, July 17th, of a piece of the meteorite which fell at Estherville, Emmet county, Iowa, on the 10th of last May. The specimen thus examined proved to be an "alloy of iron and nickel distributed in irregular masses through a matrix of rock," with a specific gravity of 5.5. The metallic parts, separated as far as practicable from all gangue matter, gave metallic iron 88.5 per cent; nickel, with trace of cobalt, 11 per cent. The gangue contained small crystals of zircon composed chiefly of zircon in granular form, intermixed with sulphides of iron and nickel, while carrying silica, alumina, lime and magnesia, but with no trace of the precious metals or copper.

THE AUDIOMETER.

After the last meeting of the Royal Society, Dr. Richardson demonstrated the action of a new instrument which he has named the audimeter, or audiometer, and which has just been invented by Professor Hughes, the discoverer of the microphone. The audiometer is used as a precise measurer of the sense of hearing. It is formed of a small battery of one or two Laclanche cells, a new microphonic key, two fixed primary coils, a graduated insulated bar, to which at each end one of the fixed coils is attached, a secondary induction coil, which moves along the graduated bar, and a telephone, the terminals of which are connected with the terminals of the induction coil. The principle of the audiometer is based on the physical fact that when the battery is in action and a current is passing through the two primary coils, the secondary coil on the bar becomes charged, by induction, whenever it is brought near to either of the primary coils; but when it is brought to the precise center between the primary coils there is a neutral point, or electrical balance, where the electric phenomena from induction cease to be manifested. By placing a microphonic key between the battery and one of the primary coils, and by attaching the terminals of the induction coil to the telephone, Professor Hughes was able to make the telephone produce sounds whenever he

brought the induction coil near to one of the primary coils and moved the microphonic key so as to make it play on a fine needle suspended in the circuit. When the induction coil is close to one of the primary coils the noise is very loud, but as the coil is moved toward the center of the bar the noise diminishes, until it ceases at the center altogether. The scale on the bar is graduated into 200 degrees, representing units of sounds from 200 to 0, or zero. At 200 all who can hear at all can hear the vibration of the drum in the telephone. At 0 no one can hear, while between the two points there are 200 gradations of sound, from the highest down to zero In using the instrument the telephone is put to the ear of the listener, while the operator moves the microphonic key, and at the same time shifts the induction coil on the graduated bar so as to measure the hearing power of the person under examination.—*London Lancet.*

THE HARVEST HYMN.

Once more the liberal year laughs out,
O'er richer stores than gems of gold;
Once more with harvest song and shout
Is nature's bloodless triumph told.

Our common mother rests and sings
Like Ruth among her garnered sheaves;
Her lap is full of goodly things,
Her brow is bright with autumn leaves.

Oh, favors old, yet ever new!
Oh, blessings with the sunshine sent!
The bounty overruns our due,
The fullness shames our discontent.

We shut our eyes, the flowers bloom on;
We murmur, but the corn-ears fill;
We choose the shadow, but the sun
That casts it shines behind us still.

God gives us with our rugged soil
The power to make it Eden fair,
And richer fruits to crown our toil
Than summer-wedded islands bear.

Who murmurs at his lot to-day?
Who scorns his native fruit and bloom,
Or sighs for dainties far away.
Beside the bounteous board of home?

Thank Heaven, instead, that Freedom's arm
Can change a rocky soil to gold;
That brave and generous lives can warm
A clime with northern ices cold.

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And by these altars wreathed with flowers,
And fields, with fruits, awake again
Thanksgiving for the golden hours,
The early and the later rain. — *Whittier.*

The work of completing the jetties at the mouth of the Mississippi river was consummated a few weeks ago, when a uniform depth of thirty feet was obtained through the jetties, with a depth of twenty-six feet at the head of the pass. This virtually completed Mr. Eads' great work of opening the mouth of the Mississippi river. His contract with the Government only requires now that he shall maintain the present depth of water for the period of twenty years.

METEOROLOGY.

METEOROLOGICAL SUMMARY FOR JULY, 1879.

SIGNAL OFFICE, LEAVENWORTH, KANSAS, August 1, 1879.

There were few features in the weather of the past month to distinguish it from July of past years.

The mean pressure of the month was 29.871, which was but slightly below the July average. The highest barometer was 30.062, on the 5th; the lowest, 29.663, on the 11th.

The mean temperature of the month was 79.85°. The July average is 78.83°. The mean of July, 1878, was 80.30°. The highest temperature of the month was 97°, on the 11th; the lowest 61°, on the 30th. The highest July temperature ever observed at this station was 104°, in 1874. The greatest daily range of temperature of the past month was 25.5°, on the 8th; the least daily range, 7.5°, on the 1st.

The mean percentage of humidity for the month was 70.91 %, near 4 % above the average for July. The greatest daily mean was 86 %, on the 17th; least daily mean, 54.7 %, on the 10th and 11th.

The total rainfall for the month was 4.99 inches, about one-fourth of an inch below the average. The greatest July rainfall ever recorded at this station was 9.99 inches, in 1872; the least, 2.04 inches, in 1873.

The prevailing wind of the month was south. Total number of miles registered, 4,912. Highest velocity, 33 miles, from the northwest, at 9:25 p. m., 7th. During the month the wind was noted—blowing from the north, 30 times; northwest, 9 times; west 2 times; southwest, 10 times; south, 76 times; southeast, 40 times; east, 22 times; northeast, 19 times, and calm 9 times.

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A lunar halo was observed at 2:40 a. m. of the 7th.

Six thunder storms passed over the station during the month.

Number of clear days during the month, 8; fair days, 15; cloudy days, 8, and days on which rain fell, 12.

YEAR.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
		deg's.	per c't.	inches.	deg's.	deg's.		
1872	29.972	78.43	——	9.99	94	62	——	——
1873	29.915	77.50	61.00	2.04	94	55	30.243	29.604
1874	29.886	82.80	59 50	3.23	104	62	30.097	29.502
1875	29.893	77.60	73.70	8.82	98	63	30.259	29.622
1876	29.893	78.90	69.70	4.01	95	54	30.111	29.642
1877	29.902	76.30	67.90	5.34	94	55	30.212	29.672
1878	29.876	80.30	70.50	3.08	100	61	30.121	29.519
1879	29.871	79.85	70.91	4.99	97	61	30.062	29.663
Average of 7 Years.	29.915	78.83	67.05	5.22	97	59	30.174	29.593

SAMUEL W. RHODE,
Sergeant Signal Corps, U. S. A.

MISSOURI WEATHER SERVICE, JULY, 1879.

BY F. E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

The temperature of this month has exceeded the normal at the Central Station 1.8°, and was 0.6° lower than that of July, 1878. In July, 1878, the mean temperature of the decades were as follows: 1st, 77.5°; 2d, 87.6°; 3d, 78.2°; mean, 81.6°. In 1879, the 1st was 83.4°; 2d, 81.5°; 3d, 78.3°; mean, 81°. The maximum temperature of July, 1879, exceeded that of 1878 1°. Engelmann has observed a temperature of 103.5° in this month.

The rainfall at the Central Station has been deficient 1.89 inches, and has been light throughout the State, except in the western and northwestern districts, the least precipitation occurring in the southwest.

The month is marked by a number of thunder storms, most of which were very local. Two, however, are well defined. The first entered our State from Kansas on the morning of the 17th. It passed Harrisonville and Lexington between 2 and 3 a. m.; at 3:30 a. m. it reached Boonville, passed Mexico and

Chamois at 4 a. m., and entered Illinois, passing Louisiana, Missouri, at 5:10 a. m. The second, a very violent thunder storm, entered the northwestern section of the State at Oregon, at 3:45 a. m. Its course was southeast until it reached Lexington, at 4 a. m., when it took an easterly direction, reaching Miami at 6 a. m., Glasgow at 6:18 a. m., Boonville at 6:35 a. m., Clark's Fork at 6:45 a. m., Dauphin at 8 a. m., Chamois at 9 a. m., Big Creek at 10:15 a. m., passing thence into Illinois. Several observers have neglected to note the exact time of *beginning* and *ending* of these two storms, and thus prevented my making this report as accurate and comprehensive as I would wish. Although these data of a rain storm are the easiest to obtain, they are very important and should never be overlooked or neglected.

The eastern district, although suffering for want of rain, has produced a fine wheat crop, and promises a large yield of corn. A large yield of corn is also expected in the southeastern section.

COLORADO WEATHER REPORT.

SUMMIT, COLORADO, August 20, 1879.

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Weather here cool and pleasant. Five hail storms and three light snows so far this month. Yours truly, C. E. ROBINS.

EDITORIAL NOTES.

JUST twenty-one years ago the first Atlantic cable was laid, and the first message dispatched and received. Great rejoicings were had, both in England and the United States, over the success of a previously regarded chimerical undertaking. But these rejoicings were of short duration. The line was not in operation quite two weeks before the cable parted, and for more than eight years—from September 1, 1858, to July 27, 1866, none of the numerous efforts to renew the connection between the two continents were successful.

PROFESSOR OTTO STRUVE, of the Pulkowa Observatory, Russia, is now in Washington inspecting the great 26-inch telescope of the Naval Observatory, with the intention of ordering a larger one if he finds that it excels his own 15-inch glass in power. Prof. Struve, who is one of the most distinguished astronomers in the world, will be present at the meeting of the American Association for the Advancement of Science, during its session at Saratoga Springs, beginning August 27, 1879.

WE are indebted to Dr. A. R. McNair, of the Local Committee of arrangements at Saratoga, for special and personal favors connected with the meeting of the American Association for the Advancement of Science at that place this week. Everything in their power has been done by the committee to secure low rates of transportation and boarding for members and visitors, and all attending will receive a warm welcome.

WE have received from Lindsay & Blackiston, too late for notice in this number of the REVIEW, copies of Bloxam's Laboratory Teaching, a handsome illustrated volume of 261 pages; $2; and Wilson's Summer and its Diseases, being the third of the American Health Primers for popular reading; 50c.

THE Report of the President and the Board of Education of the Kansas City Public Schools for 1878–9, which should be read by all parents and guardians of children in this city, will be found to contain many gratifying items of information relative to the management, cost of maintaining, course of instruction and progress of these schools. We presume that very few tax-payers realize that, with the remarkable increase in the number of scholars, the school tax has actually been reduced to the lowest rate ever levied, instead of increased, and that $25,000 of principal and interest of the school debt of this district have been paid off within the present year. Nor is it generally supposed that the children of this city can be educated at a total expense of 3.9 cents per day each, and yet such is the case, supposing all the scholars enrolled to be in daily attendance.

Well deserved compliments are paid by the board to Superintendent Greenwood and his corps of teachers, and the thanks of the community are certainly due to the board for their faithful and efficient management.

THE Academy of Sciences of Vienna announces the discovery by Polesa, at Vienna on the 21st of August, of a comet, in ten hours and two minutes right ascension, forty-nine degrees and six minutes north declination, with a daily motion of plus six minutes minus three minutes.

MORE space for the display of agricultural machinery at the Kansas City Exposition this fall has already been secured by exhibitors than was occupied by them all last year, although that was considered by everybody as the finest display ever made in the West

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PROFESSOR C. W. PRITCHETT, of the Morrison Observatory at Glasgow, Missouri, proposes to supply Kansas City with standard time by means of an electric time-ball, placed above the Union Depot and dropped each day precisely at noon. Mr. Nettleton, manager of the Union Depot, and Mr. McMullin, Superintendent of the Chicago & Alton Railroad, are considering the matter and propose to make the necessary arrangements as soon as practicable.

Such a ball has been in operation at New York for over a year without a single failure, and is always within 0.5 of a second of absolute correctness.

Although this will be no little trouble to Prof. Pritchett, he proposes to operate the time-ball the first year without charge, if the railroad companies will provide the connections, ball, etc.

PROFESSOR INMAN, of the Larned *Chronoscope*, is spoken of for Governor of Kansas in 1880. As he is a practical scientist instead of a politician, his nomination is somewhat uncertain, but if elected he will be one of the most intelligent and energetic governors the state has ever had, and the necessities of the plains, on which he is enthusiastic, will by no means be overlooked.

THE citizens of Denver have organized a Historical and Natural History Society, the main object of which is the preservation of records, personal narratives, documents, relics, etc., also the accumulation of books and specimens of mineral wealth which so abound in Colorado. If properly managed, there need be but little delay in obtaining the finest collection of such things in the United

States, as every single citizen, great or small, has already on hand from one hundred pounds to as many tons of ores, fossils, etc., of which he will be glad to contribute to such a cause.

EXTREME cold and fumigation having both failed as destroyers yellow fever germs, it is now proposed to effect their destruction by heat, and the use of steam is recommended as the most convenient, safe and effectual means of applying the heat. This suggestion is based upon the Persian treatment of the plague—infected patients being cured by subjecting them to a bath of air heated to a temperature of 112° to 130° Fah.

THE hottest day of August, according to our thermometer, was Monday, the 4th, when the mercury stood as follows: At 7 a. m., 81°; at 2 p. m., 94°; at 10 p. m., 85°.

A GERMAN traveler, Otto Schult, addressing the Lisbon Geographical Society, August 22, says he has made a pretty exact survey of the region between the Quango and Cassai rivers, in Africa.

ITEMS FROM THE PERIODICALS.

THE London England, *Monthly Journal of Science*, opens with an article upon "England's Intellectual Position," in which the writer sharply criticises the manner and character of the teaching done in her universities, and institutes several unfavorable comparisons between the influence and position in the world of her scientific and literary professors and those of America, Germany and other nations. This, he attributes to the deplorable English system of education and not to any inbred deficiency of the countrymen of Newton, Faraday, and a few living biologists and physicists.

AN editorial article in the London *Telegraphic Journal* for August describes the results of the use of the electric light on the Embankment, and states that after several months of experiment with the Joblochkoff's candles, the Metropolitan Board of Works has concluded that they have decidedly the advantage over gas in price and lighting power, and has ordered an extension of the candles over Waterloo bridge and up Northumberland Avenue. This shows that this great invention is slowly but surely making headway, and foretells the final general adoption of a cheaper and better light than we now have.

IN the London *Chemical Gazette* for August Dr. T. L. Phipson, who has been publishing a series of articles on "The Analysis of Water," with copious examples, alludes to the presence of phosphoric acid in potable waters as an important indication of sewage contamination, and describes the water of the river Dart as containing 52.50 grains per gallon of residue, consisting of 17.52 grains of Nitrogenous organic matter, 3.25 grains of Phosphoric acid, and 31.75 grains of Carbonate of Lime, Sulphate of Lime, &c., and yet the water was only "somewhat turbid," deposited only a "slight amount" of organic matter and was neutral to test paper.

AN interesting account is given in *Iron* (London, August 2d) of the Annual Meeting of the Institution of Mechanical Engineers, which alternately holds its sessions in London and the provinces. On such occasions excursions are taken in all directions, and all of the manufacturing establishments of the locality are minutely and intelligently inspected. This year the institution meets in Glasgow, where such establishments are peculiarly attractive, from their great number and extent, their almost endless variety, and from their great age, in cases like the Rollox works, which commenced on a small scale in the latter half of the last century and are now the greatest chemical manufactories in the world.

THE London *Journal of Applied Science*, edited by Prof. P. L. Simmonds, a scientific writer of distinction in England, contains a full monthly summary of progress in the industrial arts, compiled from all available sources, and is one of the most useful publi-

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cations that reaches our table. The office of the editor has lately been removed to 61 Cheapside.

A VERY interesting description of the University Observatory, Oxford, England, is given by Professor C. Pritchard, F. R. S., in the *Observatory* for August, from which it appears that although the means of instruction are unusually ample, the number of students in this branch is quite limited, owing to the the fact, as is gravely stated by the Professor, that such rewards as are offered for proficiency in other studies are not held out to students of astronomy. During the Michaelmas term, but fourteen students attended the astronomical lectures; in the Hilary term, two; in the Easter and Trinity terms, ten.

ACCORDING to *The Farm*, published at Dublin, Ireland, the statistics of that country show by no means a flattering picture, indicating, as they do, a falling off in the production of nearly everything in the agricultural line, and a withdrawal within the past five years of not less than £5,699,780 from the only industry Ireland possesses.

Sunday Afternoon, of which we have several times spoken, as a most excellent household Magazine, and one which is highly appreciated wherever read, enters upon a new volume and assumes the new title of *Good Company* with the October issue. We see no advantage in this change of name, but suppose it has been made to disabuse the minds of certain over-suspicious persons of the erroneous idea that it was a strictly religious and therefore necessarily uninteresting Magazine. The editorial management remains, as heretofore, in the hands of Mr. E. F. Merriam, and the list of contributors insures a continuation of the sprightly, instructive, first-class, moral articles which have heretofore characterized it.

THE essay in the *Sanitarian* for August, by Dr. Chas. Denison, of Colorado Springs, Colorado, upon "Out Door Life," is fully worthy of the leading position in that excellent journal, and one that should find place in all the Hygienic periodicals of the land. It is not only well written, but it is backed up by indisputable facts; and, while it is intended mainly as an argument for Colorado's delightful climate, the points made apply with full force to life out of doors anywhere, except in swamps and in the alleys of filthy cities.

NOTHING we have seen on the subject of Summer Resorts, this season, has so attracted us as the impressions gained from the *Chautauqua Assembly Herald*, of the delightful combination of pleasure and profit, idleness and instruction, *san souci* and science to be enjoyed by the visitors at Lake Chautauqua, N. Y., during the hot weather. Aside from the satisfaction to be derived from the cool atmosphere, charming lake scenery and the fascination of sailing and fishing, there is an Annual Sunday School Assembly at what was once known as Fair Point, now Chautauqua, at which all the distinguished preachers and teachers, and many well known scientists and visitors, are present and devote themselves to elegant and useful recreations, such as scientific lectures, sermons, literary essays, &c. All these are reported in the *Herald* and sent all over the country. It is a large, handsome, eight-page paper, well edited, and very cheap at the price of $1.60 per annum, daily during the vacation season, and monthly the remainder of the year.

WE learn with regret that the *American Quarterly Microscopical Journal*, which has been so ably edited by Prof. Romyn Hitchcock, will be discontinued with and after the July number.

THE *American Naturalist* for September publishes a highly appreciative testimonial to Dr. Elliott Coues, U. S. A., signed by Huxley, Darwin, Mivart, Wallace, Günther, and other eminent zoölogists of England, expressing their warm approbation of the Bibliographical Appendix to his work on the Birds of the Colorado Valley.

IN the *Mirror of Progress* for August 23d, we find an interesting geological article from the pen of Judge West, entitled Following the Pick and the Spade, conveying valuable information relative to the formations of this locality.

AMONG the many valuable articles offered by *Van Nostrand's Engineering Magazine* for September, none perhaps will prove more interesting to the general reader than that entitled "The Work of the smith in the Sixteenth, Seventeenth and Eighteenth Centuries," while to the technical ones, doubtless, those on "Logarithms," by Prof. Merriman, and the "Mathematical Theory of the Motion of Fluids," by Prof. Craig, will be studied first.

PROF. S. F. PECKHAM, of the University of Minnesota, in a late letter to the *Chemical News*, calls attention to his article in the *American Journal of Science*, attributing the explosions in the flouring mills at Minneapolis, May 2, 1878, to the cause suggested in the REVIEW for that month, and confirmed a few days later by the verdict of the jury, viz.: the sudden ignition of a large amount of inflammable dust floating in the atmosphere, the force of the explosion in the first mill carrying the flames through the windows in the second and third, etc.

THE *Atlantic Monthly* for September, contains; Cæsar's Art of War and of Writing; Miss Magdalena Peanuts, Phœbe Yates Pember; On Latmos, Miss L. W. Backus; Mountains in Literature, Thomas Sargent Perry; Irene the Missionary, XXIII–XXVI; Married Bohemians, Edgar Fawcett; The Use of Numbers in Society, N. S. Shaler; The Race, and Why Yale Lost It; American Finances from 1789 to 1835, II., John Watts Kearny; Genesis, Ernest Dale Owen; Songs and Eccentricities of Birds, Wilson Flagg; A Tennysonian Retrospect, Julius H. Ward; Recent Novels; A Lesson in Picture, Sallie M. B. Piatt; "Nobility and Gentry," Richard Grant White; A Word to Philosophers, Christopher P. Cranch; Story-Paper Literature, W. H. Bishop; The Contributors' Club; Recent Literature; The Jennings Sanitary Depot and Colonel George E. Waring.

THE *North American Review* for September presents the following attractive table of contents: The Genius of Nathaniel Hawthorne, by Anthony Trollope; The Standard of Value, by Professor Simon Newcomb; The Work and Mission of My Life, Part II., by Richard Wagner; The Diary of a Public Man, Part II.; Confession of an Agnostic, by an Agnostic; Intrigues at the Paris Canal Congress, by A. G. Menocal; Three Important Publications—Finlay's History of Greece, Pattison's Renaissance of Art in France, Cox's Aryan Mythology—by Mayo W. Hazeltine.

Appleton's Journal for September is at hand and, as usual, is filled with excellent matter. Its book reviews are always especially noticeable for their thoroughness and truthfulness. Among the numerous good articles, those upon A Venetian Night, by Miss Adams, and An Hour with Thackeray, by John Esten Cooke, are particularly attractive. The serial stories are well sustained, and the whole number is fully up with its contemporaries.

THE *Popular Science Monthly* for September has not yet appeared upon our table, being behind-hand for the first time in almost three years. Not one of our exchanges is more missed when not promptly received.

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